2. Land Use

2.1 Campus Ecology

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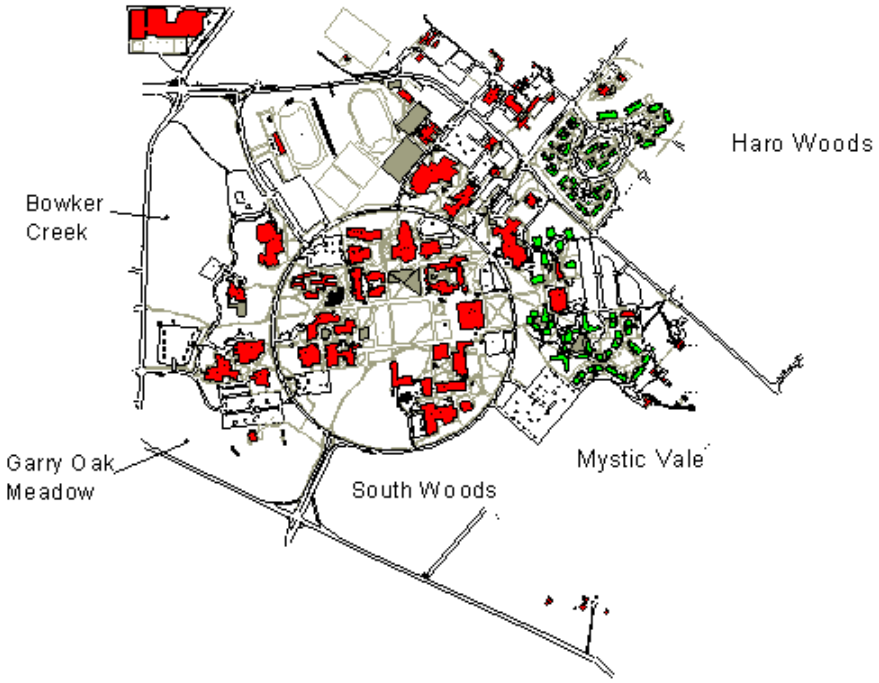
Natural Areas of the University of Victoria Campus 2000



Adopted from UVic Facilities Management 1999 and accessed using the Geography Map Library's Arc View program 3.2

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Introduction:

Appropriate land use and management is increasingly becoming one of the major global issues confronting national and regional governments. Habitat destruction and fragmentation as a result of human interference is now recognized as one of the most serious threats to global biodiversity and sustainability (Primack 1993). All of the worlds biomes including rainforests, grasslands, wetlands, and even marine environments are under siege from development, overpopulation, overconsumption, exotic species introduction, and human induced environmental change.

The University of Victoria is currently a signatory to the Talloires Declaration that involves a 10-point action plan to promote education for sustainability and environmental literacy. This declaration, which has been signed by 265 other educational institutions around the world, involves the promotion of environmental education and awareness, and the encouragement of institutional ecology based planning, resource conservation and environmentally sound operations (Association of University Leaders for a Sustainable Future 1994). Statements from the strategic plan of the University of Victoria further reveal its desire to be environmentally responsible:

> "Universities should play a leading role in instigating and facilitating societal change and in reducing human impacts on the environment. All aspects of universities should reflect environmental concerns, including their location, design, policies and practices, educational programs, research undertakings, and the built environment. It is important that the University of Victoria take specific steps which relate to environmental issues in their own right" (University of Victoria 1999).

The original campus plan envisioned a maximum of 10,000 students (Wurster et al. 1961). However, at this time there are approximately 15,000 full time students, with enrolment increasing at approximately 2% a year. In 2025 the projected number of students attending the university is expected to exceed 23,000 (University of Victoria, 1998). In the coming years the increasing student population will certainly place more pressure for development on the remaining land of the campus, a situation similar to what is happening on a global level.

Methodology:

The UVic Sustainability Project was founded in the spring of 1999 by two students, Lindsay Cole and Alex Blais, with a mandate to determine the ecological, economic, and social sustainability of the University of Victoria campus. In the fall of that year I was hired to conduct the Campus Ecology component of the study as a part of a team of fellow auditors. My research was conducted from October 1999 to April 2000, with writing completed in June 2000. I examined the sustainability and environmental considerations of the university in regards to the current health of and long-term land use plans for the remaining natural areas of the campus. The study had several main objectives, which included:

1) An evaluation of the sustainability of university policy regarding planning, siting and development of the natural areas on campus.
2) An assessment of the complex ecological community on the University of Victoria campus, including present and historical plant communities and wildlife species.
3) An evaluation of the university community values towards campus ecology issues.
4) A determination of the effort of the university to assess, document, monitor, conserve, restore and review the natural areas of the campus.
5) An assessment of the degree of communication and community education that the university conducts to improve understanding, awareness and stewardship of these areas.

My main research methods included interviews with university professors, facilities management, community members and local experts. I also performed some direct independent research including campus bird surveys, a student questionnaire, and habitat mapping in conjunction with a visual artist. More detailed methodologies regarding the habitat mapping, campus bird surveys and student questionnaires are summarized below. The sustainability aspects were developed in response to my collective research and are a reflection of the objectives of the study. For a more holistic picture of the sustainability aspects please consult the Executive Summary titled 'Sustainability at the University of Victoria: A Discussion Document.' For more detailed information regarding sources of information see the reference list and Appendix 1.

Mapping Methods:

As I got deeper into this project I realized that not all of the smaller projects that I had envisioned could be completed given the time allotted and the resources at hand. I had initially planned to do a detailed campus map demonstrating the precise vegetation characteristics in all of the natural areas of the campus. Training sessions with the Victoria Natural History Society and a workshop with Briony Penn (a local community ecological mapping consultant) helped me develop my mapping skills, yet made me realize the full extent of the task at hand. With several other projects on the go and after

an examination of some work done by the Westland Resource Group on the natural areas of the campus, I realized that my goal wasn't very realistic. So instead, I opted for the production of an artistic rendition of the natural areas of the campus in the form of an information brochure and trail guide. The production of this guide will be completed by artist Chad Wilkinson and published in August 2000. To do this Chad and I walked the trails of the campus using GPS units, and then with the help of Terry Moen in Facilities Management were able to plot the trails on to several baseline maps of the university. These were then used as the background maps for the trail guide.

Determination of Campus Ecological Characteristics:

I also did a lot of individual research and investigation of the natural areas of the campus through discussions with individuals in the Biology, Environmental Studies and Geography departments, as well as Facilities Management, Saanich Parks, Saanich Environmental Services, and the Pacific Forestry Center. Information was also gathered through the Capital Regional District and Ministry of Environment Lands and Parks websites, as well as through the Trillium project. I was also lucky enough to be involved in Biology 418 (Plant Ecology) in which a large component of the laboratory was spent investigating the vegetation dynamics of the campus.

Understanding Campus Wildlife:

I realized early in my research that not much had been done to monitor and inventory wildlife populations on campus. I also realized that determining wildlife species presence is a full-time undertaking that couldn't be completed in a six month winter project. Much of the information that I was able to gather was through interviews with individuals in the Biology department, literature review, personal observations in the field, and through a campus bird survey.

Much of my inventory efforts involved a winter bird survey of the campus with the help of several volunteers from the Biology department. Bird surveys were conducted every Friday morning from the end of January to the beginning of April from 8:00 AM to approximately 10:00 AM. The survey consisted of point counts at 15 fixed stations distributed throughout the natural areas of the campus. The duration of the point counts was six minutes each, and the environmental conditions were recorded at each station. The bird survey data form can be seen in Appendix 3.

Research volunteers Paul Levesque and Gavin Bieber also conducted owl surveys on six occasions on campus to determine species presence. Results from the bird and owl surveys were compiled and compared to historical accounts and other sources by Paul Levesque. Paul also produced a bird checklist for the University of Victoria campus, which can be seen in Appendix 4. Please see a more detailed description of the techniques used for this portion of the study on pages 19 and 20 of this report.

Questionnaire Methodology:

I assessed student values and awareness of the natural areas on campus using a questionnaire (Appendix 5). Some of the questions used in the questionnaire were adopted from a survey done through the Trillium Project (Taves 1994), but were altered slightly so that they were less directional in their response. I composed the remaining questions to meet the objectives of the study. In general, I found it quite difficult to design a survey and distribution technique that was not biased in any way. I avoided as much as possible questions that directed respondents to reply in certain ways, and strived to develop a sampling protocol that was random. In this way I hoped to attain results that could be extrapolated to the campus community.

The questionnaire was distributed in conjunction with fellow auditors Simon Hocking and Shane Thomas who were also conducting questionnaire surveys. We decided to survey the student population so that the number of respondents per faculty of study corresponded to the actual distribution of students in each faculty. This distribution of students was based on the student statistics from the UVic Campus Plan Update of 1998. Initially I determined that a sample size of 500 students in total would be acceptable, and that we would base our sampling on undergraduate students by going to randomly selected classes in each faculty during the months of February, March and April 2000.

Classes in each faculty were randomly chosen from the list of classes (from the UVic webpage) offered in the spring semester. Professors were contacted via e-mail for permission to visit the classes to distribute the surveys. On some occasions professors denied access to the class and we had to resample. Simon, Shane and I went to the selected classes and distributed our questionnaires. Most often, individual students responded to just one of the questionnaires but in smaller classes multiple surveys were often given to each student. Students generally completed the questionnaires in the first five minutes of class time and then handed them back to the front of the class. Classes in each faculty were sampled until the appropriate number of students was obtained based on a total sample size of 500.

The faculty of Graduate Studies was the most difficult to sample randomly. Questionnaires were placed in student boxes in 8 departments (Anthropology, Biology, Business, Education, Engineering, English, Fine Arts, and Social Work) with instructions to return the survey to the department office for collection.

Sustainability Aspects Executive Summary:

2.1.1 The University has a policy, or a documented management plan, in place indicating how the natural areas of the campus will be managed sustainably over the long-term. Rating: ★★

2.1.2 The ecological characteristics and health of the natural areas on campus are known, understood, studied, and considered in all planning and development activities. Rating: ★★

2.1.3 The wildlife species present on campus are known, understood, studied and considered in all planning and development activities. Rating: ✯

2.1.4 The value to humans of the natural aspects of the UVic campus are known, recognized, fostered, and considered in all planning and development activities. Rating: ✯✯✯

2.1.5 There is a consistent effort on the part of the University to determine potential restoration and improvement projects in the natural areas of the campus. Rating: ✯✯✯

2.1.6 There is a consistent effort on behalf of the University to make the landscaped areas of the campus mimic the natural surroundings of the campus and/or to model the historic ecosystem type and function. Rating: ✯✯✯

2.1.7 The University assesses, documents, monitors, reviews and communicates the changing state of the natural areas on campus over time in order to adapt to and effectively manage these areas. Rating: ✯✯

2.1.8 The University strives to educate the campus and surrounding community about the natural areas on campus and the role that they can play as stewards of these areas. Rating: ✯✯

Sustainability Aspects:

2.1.1 The University has a policy, or a documented management plan, in place indicating how the natural areas of the campus will be managed sustainably over the long-term. Rating: ✯✯

At this time the University of Victoria has no single policy in regards to the long-term sustainable management of the natural areas of the campus. Under the Landscape Concept the university states that "the natural areas be preserved as long as possible, and...that the final concept is defined in terms of trees and lawns" (University of Victoria-Policies 1974). This statement reveals that at some level the university recognizes the value of the natural areas but ultimately other factors may be of higher concern.

The recent statements in the Campus Plan Update in October 1998 reiterate this contradiction. In this report the university recognizes the importance of several of the natural areas on campus as 'unique places' and states that, "there are some areas on campus which should not be developed and there are others where any further development should be limited or carefully designed to recognize their unique environmental qualities" (University of Victoria 1998). I commend the university highly for further mentioning that "there are issues which must be addressed relative to the connectivity of sensitive areas both within the campus and with regard for the larger community context" (University of Victoria 1998). At the same time however, when the university considers constraints to future campus growth it reveals that; "many of the factors affecting the ultimate growth decisions will revolve around issues related to the teaching and research missions of the university as well as evolving teaching methods rather than physical conditions on the campus". Furthermore, the university "... will not

presume to set a cap on either enrolment or building space" (University of Victoria 1998). When taking all of these statements into consideration, no clear picture emerges regarding long-term land use decisions to be made on the campus.

The university's recognition of the values of the natural areas is a step in the right direction. However, the absence of a clear policy indicating the means by which the university aims to minimize the long-term adverse impacts on the campus environment with the continued increase in enrolment is disturbing. It remains unclear how the university plans to manage the natural areas of the campus sustainably over the long term, given their primary research and teaching mission, and the demands that will be placed on the ecological areas in the future.

The current draft of the Campus Plan Update has 15 basic planning principles. These refer to the fact that facility siting, development, and design will recognize the importance of minimizing impacts on the environment, and that the physical setting of the campus will be preserved to the maximum extent consistent with the programmatic requirements of the university. It is imperative that the university takes steps to implement a management plan in order to realize these commitments. Planning ahead in order to prevent environmental damage is much more sustainable than intervening when the damage has already taken place (Archibugi 1997).

I propose that a new university policy be developed entitled the 'Natural Areas Policy' similar to that which has been developed for Finnerty Gardens. The Finnerty Gardens policy recognizes the importance of this area to the university community "as an area of great tranquility and beauty" and "as an inventory and place of study of botanic material for educational purposes" (University of Victoria-Policies 1995). Do the natural areas of the campus not have similar or greater values of this nature? The importance of intact native communities of plants and animals for educational, ecological and social purposes is immeasurable, and is at least as valuable as a human-made botanical garden (Antos 2000, Costanzo 2000, Reimchen 2000, Turner 2000).

There are elements within the Finnerty Gardens policy that could easily be incorporated into a separate 'Natural Areas Policy' (University of Victoria-Policies 1995):

1) Overall planning, development and maintenance of the natural areas in accordance with their ecological principles and requirements.
2) Maintaining a master plan and inventory of the natural areas.
3) Liaisons with appropriate organizations and community members on and off campus.
4) Providing operational liaison between the University, the Campus Development Committee, departments and students regarding campus environment issues

Other possibilities to be included in such a policy include: statements regarding the continued monitoring of the natural areas, restoration planning, and education of the campus and surrounding community regarding campus ecology issues.

A 'Natural Areas' policy is an essential first step for addressing the issue of sustainable land use on the University of Victoria campus. A university policy such as this would provide the framework for coordinated assessment, inventory, monitoring, education and restoration of the remaining natural areas, as well as a system for further communication and contribution by affinity groups.

2.1.2 The ecological characteristics and health of the natural areas on campus are known, understood, studied, and considered in all planning and development activities. Rating: ★★

Introduction:

In the past six months I have gained an understanding of the unique environmental qualities and characteristics of the natural areas on campus through ecological mapping, course work, interviews with various individuals, selected projects and personal research. My main objectives in this research area were:

1. To develop an understanding of the major plant community types on campus including vegetation dynamics, successional stages, and relationships to abiotic factors.
2. To perform a site by site analysis of the main natural areas of the campus.
3. To investigate environmental health concerns within the natural areas such as exotic species, poor drainage and tree health.
4. To determine the degree to which the university considers and embraces the ecological conditions and requirements of these areas for the goal of long-term sustainable management.

The University of Victoria campus is in the Coastal Douglas Fir Biogeoclimatic zone, which lies in the rainshadow of the Olympic Mountains and the mountains of Vancouver Island. As a result it receives approximately 70cm of rain annually, and is characterized by mild wet winters and warm dry summers (Cannings and Cannings 1996). This ecosystem is thought to be one of the most endangered in North America (Walker 1994), with the Garry Oak woodlands considered highly diverse but ‘critically imperiled’ (Capital Regional District 2000).

The forested areas of the campus may have once consisted primarily of Douglas fir with a Salal-Sword fern understory (Westland Resource Group 1993). Well drained, open areas with Garry Oak and Arbutus interspersed with native grassland meadows would also have most likely been highly present in the campus area (Antos 2000). Soils on campus are characterized as dark gray gleisolic, and are generally quite poorly drained due to three slowly permeable clay layers that underlie the surface loam (Farstad and Day 1959). Prior to the purchase of the land by the university human activities such as logging, agriculture, construction, and military activities, as well as several fires between 1886 and 1905 severely altered the original landscape (Ketcheson et al. 1975). As a result the majority of

the forest stand is now less than 100 years of age and is becoming increasingly more isolated from other intact habitats.

The remaining relatively intact, though not undisturbed, habitats on campus are mostly contained within planning sub-areas 4, 6, 11, 22 and 24 (University of Victoria 1998), and are referred to as the South Woods, the Garry Oak meadow, Bowker Creek, Mystic Vale and Haro Woods respectively. The Garry Oak meadow, Mystic Vale and Bowker Creek have recently been classified as 'sensitive ecosystems' as a part of a municipal sensitive ecosystem inventory due to their unique ecological characteristics (CRD/ PCC Green/ Blue spaces strategy 1996).

Ecological Areas of the University of Victoria Campus:

The remaining natural components of the UVic campus are contained primarily within the five areas listed above (see covering page for locations). The combined area of these five environments on campus is approximately 81.6 acres, or about 20.3% of the university's Gordon Head lands (University of Victoria 1998). There are other smaller pockets of remnant forest on the campus that also have value but are not discussed in great detail. Examples include the small area behind the Begbie building and the Cunningham woods within Ring Road. These areas provide foraging and nesting sites for wildlife species and are important transition or buffer zones between the natural and more formal landscapes. Plants found ubiquitously throughout the natural areas of the campus include Indian plum, Snowberry, Sword fern, Grand fir, Douglas fir and Bigleaf maple, as well as the exotics English ivy and holly. For a complete list of all the known plant species present within the campus community see Appendix 2.

Mystic Vale:

The Mystic Vale protection area was created on August 10 1993 when it was jointly purchased from Sherwood Oak and Bay Meadows Estates by the university, the Municipality of Saanich, and the Provincial Government (Iachetti et al 1999). Initially Mystic Vale was slated for development, yet great public pressure to preserve the area has resulted in its protection and consideration as a sensitive and unique ecological community.

Mystic Vale is characterized as a second growth forest dominated by Douglas-fir, Grand fir and Bigleaf maple, and is highly valued as a representative remnant of native vegetation that is rapidly disappearing within the CRD. It is home to more than 75 native plant species as well as numerous wildlife species that includes Great-Horned and Barred owls, Cooper's Hawks, Bald eagles, Ravens, Piloted, Downy and Hairy woodpeckers, various songbirds, Black-tailed deer, and several rodent and bat species (Westland Resource Group 1993). Most of the older trees in Mystic Vale are between 100 and 150 years of age, a testament to the history of logging, fire and other human disturbances that have occurred in the recent past (Chatterson 1995). Several trees appear to predate these disturbances, but no direct measurements of age has been performed, and an age of 350 to 500 years has been estimated (Turner 2000). Different plant community types that are present in Mystic Vale vary primarily as a result of aspect and drainage. The water shedding upper flanks of the ravine contain species such Arbutus, Salal and Oregon grape

due to the drier, more well drained conditions. The water receiving basin of Mystic Vale is a site that is generally quite moist year round and contains unique plant species such as skunk cabbage, water parsley, and false lily of the valley. This site would normally contain Western red-cedar, an indicator of flood plains and moist sites (Pojar & Mackinnon 1994). However, this is not the case and it is not clear why this may be, other than the historical impacts of selective logging. Other common plant species include Sword fern, Licorice fern, Lady fern, Snowberry and Indian plum.

The main challenge for the university at present is to maintain and improve the natural conditions of Mystic Vale such that the area will not be adversely affected over the long term. The commitment to protect Mystic Vale by the university was a good first step, however future management decisions regarding land use within and around Mystic Vale will determine its inevitable health and stability. Some current and potential concerns regarding the management of this sensitive area include:

1) Competition and disturbance by exotic species such as English ivy, holly and Daphne on the native vegetation of Mystic Vale.
2) Bank erosion and unstable slopes as a result of, increased flow of Hobbes creek during storms, further development occurring adjacent to Mystic Vale, and excessive human use (bikes, off trail use, etc..).
3) Stream contamination as a result of runoff from parking lot 1 and lands outside of university ownership, and leaching of chemicals and nutrients from the Haro road composting facility.
4) Isolation and fragmentation of Mystic Vale as a result of neighborhood encroachment, poor management, and further development of the university lands.

South Woods:

The South Woods is a section of forested habitat 30.5 acres in size that borders the Henderson road entrance, Cedar Hill X road, Ring Road and the Haro road right of way. It forms a continuous landscape upland of Mystic Vale and thus acts to increase the effective size of the protected area. These woods can be classified as second growth forest dominated by Douglas-fir and Grand-fir with the majority of trees younger than 100 years of age. However, given the upland nature of this site there is much more of a mosaic of community types than Mystic Vale. This is likely a function of varied drainage patterns and historical factors. Arbutus, Bigleaf maple, Black cottonwood, Western yew and Cascara are present in various abundance throughout the area. The main native understory species that are present include Ocean spray, Indian plum, Snowberry, Pink Fawn-lily, White Fawn-lily, Sword fern, Trailing blackberry and Orange honeysuckle.

The eastern portion of the area near to the composting facility is quite swampy in some areas and contains large Black Cottonwood, an indicator of moist or disturbed sites (Pojar and Mackinnon 1994). This area drains into Mystic Vale to the east through a culvert as a result of fill that was dumped along the Haro road right of way in the 1960's (Westland Resource Group 1993). In some areas the fill is up to 15 meters deep and may have altered the natural drainage patterns of some of the upland forest. Other areas are

obviously well drained supporting healthy arbutus and Douglas fir as well as Ocean spray, Salal and Indian plum. Grand fir is quite prominent throughout the woods, possibly due to fire suppression in the last 80 or more years (Hocking 2000a).

The South Woods have also been highly affected by human disturbances such as logging and clearing, and contain trees that are mainly younger than those present in Mystic Vale. In a study on the natural areas of the campus by Chatterson (1995) it was found that there was 85.5 and 53.1 cubic meters of course woody debris per hectare in Mystic Vale and Ring Road woods respectively. These values are much lower than undisturbed stands of similar species composition, a testament to the history of firewood collection, logging, and clearing on UVic lands.

Presently, the university recognizes some of the values that this area possesses and recommends that; "any development in this area must be based on a careful environmental inventory to identify and describe current and projected future conditions which should be respected" (University of Victoria 1998). This area has significant ecological value due to the fact that it consists of a variety of seral stages and that it connects Mystic Vale to the Garry Oak meadow. It is essentially a transition zone between these areas and thus contributes greatly to the diversity at UVic. In the past few years the area has supported a breeding pair of Cooper's hawks and is highly used by several pairs of Barred owls, ravens and many songbirds. Owing to the presence of the owls and hawks, the area must contain reasonable populations of small mammals. Personal observations of owl pellets that contained small mammal skulls support this hypothesis. Thus, even though the area is not considered in the Sensitive Ecosystem Inventory it has diverse ecological values that should be carefully considered by the university before any decisions are made. Development that proceeds in this area will have a direct impact on the wildlife population within this area as well as wildlife in adjacent areas due to further fragmentation. Any reduction in nesting habitat and prey base would correspondingly reduce the viability of the top-level bird predators.

Bowker Creek:
The Bowker Creek area is mainly contained within planning subarea 11 with smaller portions within subareas 9 and 10 (University of Victoria 1998). It is unique in that it forms the headwaters of the Bowker Creek watershed, which formerly contained a healthy run of anadromous salmon prior to human development in the Victoria area (Friends of Bowker Creek 2000). Planning subarea 11 is a 18.2 acre parcel of land that runs parallel to Gordon head road and is separated from the Garry Oak meadow to the south by a parking lot. It has been considered as a part of the Sensitive Ecosystem Inventory due to its unique environmental attributes (CRD/ PCC Green/ Blue spaces strategy 1996) and is considered to have possibly the highest value to wildlife on the UVic campus. A high diversity of songbirds species inhabit the area as well as a breeding pair of Cooper's hawks (pers. obs.). The area is also home to various woodpecker and owl species, and until recently the rare Western Screech owl nested in this area (Winchester 2000).

Bowker Creek contains a mix of coniferous and deciduous trees due to the presence of the creek and associated wetlands. The dominant tree species include Douglas fir, Grand fir,

Black cottonwood, Trembling aspen, Red alder and Bigleaf maple. The large Black cottonwood trees found throughout the area seem to be the largest and oldest of this species on campus. Due to the age of these cottonwoods which are an indicator of flooded sites (Pojar & Mackinnon 1994), it seems strange that the University considers this area to consist of 'artificial wetlands' (University of Victoria 1998). The main shrub species include Salmonberry, Himalayan blackberry, Snowberry, Red-Osier dogwood, and Nootka rose. These wetlands greatly increase the diversity of landscape and species on the campus. Furthermore, this area has quite dense vegetation in some areas, as well as a lot of course woody debris that provides cover, foraging and breeding sites for a variety of species. The moist areas are possibly home to several native amphibian species, though no coordinated inventory has been completed to my knowledge.

As a part of the original campus plan Bowker Creek and the Garry Oak meadow were intended as locations for academic expansion and graduate studies (Siddall & Dennis 1964). Presently, the university suggests that "the area adjacent to Bowker Creek may be suitable for development" (University of Victoria 1998). This area is listed as one of the 'unique places' of the campus but is not described as a sensitive ecosystem within the planning assessment. The Bowker Creek area is considered to be one of the favorite places of several botanists of the university, Dr. Nancy Turner and Dr. Joe Antos. In the past this area has also been used for educational purposes for several classes (Costanzo 2000). If development occurs there will not only be a significant loss of habitat and diversity at UVic, there will be serious concerns regarding stream drainage, contamination and disruption. Some issues of serious concern if development occurs include:

1) Significant reduction in nesting and foraging habitat for birds that use this area. This includes Cooper's hawks, Barred and Great-horned owls, Ravens, and several woodpecker species.
2) Further fragmentation and disruption of the natural wetland habitat that contributes greatly to the diversity at UVic. Possible loss of species such as amphibians whose presence is undetermined at this time.
3) Alteration of the natural drainage pattern which forms the headwaters of Bowker Creek. Could result in increased erosion downstream as well as increased stream contamination from runoff from buildings and impervious surfaces. Consideration for the entire watershed would be an important factor in the decision making process.

Garry Oak Meadow:

The small Garry Oak meadow on the South-west corner of the university has possibly the highest regional importance of all of the natural areas on campus. It is also part of the Sensitive Ecosystem Inventory for Victoria along with Bowker Creek and Mystic Vale (CRD/ PCC Green/ Blue spaces strategy 1996). The Garry Oak woodlands, which are rare in the region and province, support some of the highest species diversity of any terrestrial ecosystem in B.C. The conservation data center rates the ecosystem and many of its plants and animals as 'critically imperiled' (Capital Regional District 2000). Currently the

Garry Oak habitat has been reduced to less than $1/10^{th}$ of its original extent (Erickson 1996) and thus it is essential that the university recognizes the importance of this area.

Much of the original vegetation in the Victoria area prior to human settlement would have consisted of camas meadows with dispersed Garry Oak- similar to present day Beacon Hill Park. The remnant Garry Oak meadow on campus is a reasonably well drained site with areas of exposed bedrock, lending itself to grassland vegetation. The main plant species include Camas, Western buttercup, Shooting star, Indian plum, Garry Oak and several native and introduced grasses. The oaks grade into a coniferous dominant overstory that is much more dense, most likely due to changes in moisture and soil regime as well as historical factors (Costanzo 2000). The open meadow zone is adapted to seasonal drying in late summer and is highly prone to fire (Ministry of Environment Lands and Parks 1993). Historically, fire was most likely essential in the maintenance of this landscape, as well as the diversity of associated plant species. Prescribed burning by native North Americans prior to European settlement also figured prominently in the ecology of this system (Turner 2000).

The university maintains that "development in the Garry Oak meadow will be limited" (University of Victoria 1998), but refrains from acknowledging the value of this native ecosystem on a regional level. From the description of this area within the planning document it appears that they are concerned more with appearance of this area at the corner of the campus rather than the content or health of the ecosystem.

There is high use of this area by Biology, Geography and Environmental Studies students as an educational resource, including an environmental restoration class that bases much of its course work in this area. As a result there is tremendous potential for the university to initiate a project to inventory and restore this area through the various classes and groups that use it. The Garry Oak Meadow Preservation Society is another group that could become actively involved with a project that could result in many benefits.

It has been mentioned that there is often a problem with excessive human use of the area in the from of trampling of sensitive vegetation and dumping of garden and household refuse (James 2000). If a restoration project was initiated by the university and was publicized in the community then this would allow the public to develop more of a sense of value for these ecosystems. Increased community education and involvement would most likely result in development of a system of stewardship and valuation rather than abuse and ignorance. Several recommendations for such a project include:

1) Promote and undertake research through: liaison with appropriate classes, concerned groups and community members.
2) Educate the public about restoration techniques and their importance and value to conserving natural areas.
3) Apply detailed classification and inventory.
4) Conduct controlled prescribed burning if possible. This is the most important treatment simulating natural maintenance regimes (Erickson 1996).
5) Encourage the regeneration of Garry Oak.

6) Mechanical restoration: control exotic plant species, and plant native ones.
7) Possible biocontrol of insect pests: the oak-leaf phylloxeran (*Phyloxera glabra*), and the jumping gall-wasp (*Neuroterus saltatorius*).

Haro Woods:
Haro Woods is a small parcel of land 2.8 acres in size that has been set aside as a protected area as a result of the agreement for land transfer (University of Victoria 1998). It is a second growth forest dominated by Douglas fir with typical native vegetation for this community type on the Saanich peninsula. Western red-cedar, Shore pine and Pacific yew are all present in this area, as well as the shrub species Ocean spray, Snowberry and Oregon grape. The main ecological concerns associated with the long-term sustainability of this area are similar to the rest of the campus. Exotic species such as Scotch broom, English ivy and Holly are a significant concern, as well as the size of this protected area. Haro Woods runs parallel to several residences, and many domestic species were observed to be invading this area from adjacent gardens. An education program conducted through the university to reduce the dumping of garden refuse and the spread of exotic species from private dwellings would be appropriate. Furthermore, if development proceeds in the surrounding forest in the coming years, this parcel of land could become even more isolated and degraded than at present. A university purchase of additional land in the Haro Woods area would greatly increase the chances that this ecosystem could maintain itself over the long-term.

Environmental Health Concerns:

Exotic Species:
All of the natural areas of the campus require immediate attention regarding the impact of exotic species such as English ivy on native vegetation. A Biology 418 research project in the Ring Road woods revealed that exotic species contributed greatly to the ground cover of the forest (Hocking 2000b). This has many ecological impacts including increased tree stress and mortality, competition with native shrub and herb species, and vast reduction in recruitment of young trees into the stand. Measured over a number of years this may completely alter the forest community, resulting in a complete change in vegetation dynamics and species composition. An increase in density of shrubs is also likely to increase the risk of fire during the summer, as well as contribute to safety concerns.

Removal of ivy is not an easy task. Average monthly growth of ivy in the Victoria region is approximately 17-22 cm, and the most effective method of control involves mechanical removal (Larocque 1999). However, a relatively easy thing to do which reduces its sexual reproduction is to prevent it from climbing, since it will not reproduce on the ground. Only when ivy climbs trees, shrubs or other objects will it become sexually reproductive, which is distinguished by the forking pattern of the leaves (Costanzo 2000).

The university is currently involved in an exotic species removal in Mystic Vale. This is a massive undertaking, of relatively large expense to the university, and could be improved with the help of volunteers. There is tremendous potential for concerned groups on- and

off-campus to get involved, as well as class projects in Biology, Environmental Studies and Geography. Currently, there are some concerns of the workers union that are preventing such projects from getting started (James 2000). A coordinated effort to remove ivy and other exotics from the natural areas of the campus consisting of facilities, students and concerned groups is absolutely necessary if the problem is to be fully addressed. Facilities could actively manage and coordinate the removal of exotics throughout the campus. Any class or group project could then consult with Facilities Management regarding the appropriate locations, procedures and safety concerns involved with such a program of removal.

Facilities Management could also be involved in education of surrounding community members about exotic species issues through the use of signs and other forms of communication. Since ivy invasion typically takes place along urban boundaries with parks (Larocque 1999) (a pattern observed on campus), management that focuses on external influences is essential. The dumping of garden refuse and the spread of exotics from urban gardens must be prevented for the removal of ivy from Mystic Vale to be successful. If we all realize the importance of dealing with exotic species in all our natural areas then we will have taken the first step towards more sustainable environments that interact closely with humans. For an in depth discussion of the impact and management of English Ivy in the parks of Victoria see Larocque (1999).

Impervious Surfaces, Drainage, and Water Quality:
The soils of the University of Victoria campus are characterized as dark gray gleisolic, and are generally quite poorly drained due to three slowly permeable clay layers that underlie the surface loam (Farstad and Day 1959). This has contributed to many drainage concerns on the campus and has cost the university a significant amount of money. Open lawn areas are subject to deep coring and top dressing to improve drainage, and are watered in intervals to reduce runoff (James 2000). Equipment is also prevented from being used on open areas from late October until spring to reduce compaction (James 2000). As a result, any development on campus has to be sited very carefully to reduce the drainage impacts. Excessive impervious surface coverage (i.e. parking lots, buildings, concrete paths, roads etc..) or poor siting and planning can change natural drainage patterns resulting in flooding, high runoff, erosion, and changes to vegetation communities.

Recently, the use of total impervious surface coverage in a given area has been used as an urban environmental indicator as it directly relates to the health of water resources (Arnold & Gibbons 1996). When you compare natural ground cover to areas with 75-100% impervious coverage hydrologic functions are altered dramatically. On natural ground cover approximately 40% of precipitation goes to evapo-transpiration, 10% to runoff, 25% to shallow infiltration, and 25% to deep infiltration. Areas with high impervious coverage result in approximately 30% evapo-transpiration, 55% runoff, 10% shallow infiltration, and 5% deep infiltration (Arnold & Gibbons 1996). Thus in areas of high impervious surface coverage runoff is much higher and infiltration much lower, a situation aggravated on the University of Victoria campus due to the compact soil structure. Increased severity of flooding and erosion, particularly during peak stormwater runoff, as well as lowered water tables can be consequences of high development activity.

Another less visible impact of excessive impervious surface coverage includes non-point source pollutants such as pathogens, nutrients, heavy metals, pesticides, and other toxins (Westland Resource Group 1993). Toxins such as heavy metals are of particular concern because they tend to persist in the environment. They can pose health threats to aquatic wildlife and even biomagnify in natural food chains, ultimately affecting human consumers (Arnold and Gibbons 1996).

On the University of Victoria campus there are several concerns regarding the impacts of impervious surface coverage on watersheds that are present in this area. An assessment of impervious surface coverage using GIS technology by fellow auditor Chris Bateman revealed that 48% of the ground surface within Ring Road was highly impervious. This is much higher than a 30% threshold developed by Arnold and Gibbons (1996) where impacts on watersheds are unavoidable, leading to a degraded stream. Fortunately, Ring Road does not encompass an entire watershed and thus the amount of impervious coverage in the watersheds surrounding UVic would be significantly lower. However, the erosion that is now apparent in Mystic Vale and other areas of the campus is most likely due to high runoff from impervious surfaces on campus and surrounding community. Furthermore, there is concern regarding the water quality in Hobbes and Bowker Creeks as a result of pollution from the urban environment. Field water quality sampling conducted by Biochemistry, Chemistry and Biology students would be beneficial here (See discussion of water quality by Gavin Tong: Environmental Health concerns of UVic). Several recommendations regarding impervious surfaces, drainage and water quality in context of further development include:

1) As a general policy for UVic, to think in terms of overall effects on entire watersheds, particularly with reference to Bowker Creek and Hobbes creek drainage systems.
2) Further development of impervious surfaces adjacent to natural areas will increase adverse impacts and thus should be minimized.

3) If development occurs then natural hydrologic functions of the site should be maintained as much as possible. Retaining natural contours and vegetation, limiting the area exposed to soil compaction, and a design that reduces impervious coverage will minimize impacts to the site.
4) Monitor and study impacts of erosion and poor water quality in the watersheds of the campus with student involvement to minimize cost and maximize education and stewardship.

Tree Health, Wildlife Trees and Safety:

Tree health and the long-term stability of the forests on campus is a complex issue. There are a myriad of actual and potential factors that may be contributing to the seemingly large number of dead and dying trees in several areas of the campus, particularly Grand fir around the Cunningham building and in the South Woods. Furthermore, the spread of exotic plant species is potentially reducing the amount of tree recruitment into the stand, gradually reducing tree density.

In many cases the compact, poorly drained soil of the university in combination with development and high impervious surface coverage is reducing tree root depth to the superficial soil layers. Shallow roots and exposure of trees along edges of developed land results in increased potential for blowdown, a situation that has occurred adjacent to parking lot 1 (James 2000). Furthermore, poor drainage and fluctuations in the water table could result in several environmental health consequences. In the winter many sites in the forest are excessively flooded due to slow soil drainage, reducing the ability of the roots to uptake oxygen. In summer the opposite may occur such that the forest floor dries out to the point that tree roots have difficulty taking up water from the compact soil particles. Rain that does fall at this time is often minimally absorbed as a result of high runoff. Grand fir is thought to be especially sensitive to this distribution of flooding and drought (Shore 2000). Stressed trees due to poor soil water conditions are also thought to be vulnerable to attacks by bark beetles (Ring 2000) and root disease (Crookshank 2000), whose presence on campus is undetermined at this time.

The large number of dead and dying trees on campus has resulted in an increase in wildlife habitat available to users that require this debris for reproduction, foraging or shelter. It has been found that 16% of all vertebrates in British Columbia require wildlife trees to some extent for these life history characteristics (Machmer and Steeger 1995). In a study by Hartwig (1999) on Southeastern Vancouver Island it was found that of the foraging elements for the Pileated Woodpecker, 72% were forest snags. Animal species on the University of Victoria campus that are highly dependent on these structural attributes of the forest include the Pileated, Downy, and Hairy Woodpeckers, the Northern Flicker, the Great Horned and Barred Owls, the Brown Creeper, the Red-breasted Nuthatch, the Chestnut-backed Chickadee, several small mammal species, and many invertebrates. The woodpecker species are particularly important for forest health because they feed extensively on several destructive families of beetles, including the bark beetles (family Scolytidae), which constitute the greatest source of tree mortality of any insect pest (Machmer & Steeger 1995).

The university has addressed this issue of maintaining dead snags within the forest, but continues to have safety concerns regarding the presence of snags adjacent to the campus chip trails (James 2000). This often involves the topping or removal of these trees reducing the available habitat for a variety of forest users. An investigation into the policy of Saanich Parks regarding tree safety revealed that they assume that human users use caution and common sense when enjoying the natural areas, and thus the Parks department is not held responsible if accidents occur. This view is apparently also supported by the police department of Victoria (DeShane 2000). In windstorms, when dead snags are most likely to fall, the public should be aware of the hazards that are present in these areas. Furthermore, the danger of falling branches off of living trees is often much more realistic than falling dead snags, so the reduction in relative risk by felling these snags is minimal to begin with.

Several recommendations regarding the health and stability of the trees and snag users on the University of Victoria campus include:

1) Removal of exotic plant species to prevent the reduction in tree recruitment to the forest stands on campus. A healthy forest is one with a variety of tree ages.
2) Appropriate siting and considerations for hydrologic functions will have to be done to reduce indirect tree mortality during new development.
3) Through MicroBiology, Forest Biology and Entomology programs at UVic determine the vulnerability of the forests on campus to the spread of bark beetles and root disease.
4) Do not remove wildlife trees from the forested areas of campus. If possible, adopt the policy of Saanich Parks regarding safety concerns on campus.

Environmental Connectivity:
The role and importance of connected ecosystems to long-term viability of habitats and their inhabitants is well known and has been discussed widely in the scientific literature (Primack 1993, Meffe & Carroll 1997). Isolated habitats are subject to a variety of ecological concerns from problems associated with small populations to increased vulnerability to environmental change.

Since the university has now pronounced Mystic Vale and Haro Woods as long-term protected areas it has a responsibility to ensure that these areas are able to persist into the future. The university should try to adopt many of the recommendations that I have presented above, but as a primary goal should integrate the protected areas into the surrounding natural areas to form an urban wildlands network (Stinchcombe 1995). Protection and development of public awareness for areas other than Mystic Vale and Haro Woods would increase community stewardship and acceptance, and would further enhance many individuals connection to the physical environment in Victoria.

The present protected areas of the University of Victoria campus make up 6.2% of the land area owned by the university on the Gordon Head site. The current Protected Areas Strategy calls for the protection of at least 12% of British Columbia's lands that contain representative examples of the natural diversity within the province (Protected Areas Strategy 1994). The university now has a unique opportunity to recognize the diversity that exists on the campus and to protect these areas in accordance to the goal of the province of British Columbia. Presently, if the university were to protect all of the areas that I have described above they would be committing approximately 20% of the Gordon Head lands to long-term protection. Though I understand that there are many other factors that would lead to a decision of this nature, I feel that this is an appropriate target for the university considering that as an educational institution it should be at the forefront of the conservation initiative in British Columbia.

Discussion:

The university has started to perform better in the last ten years regarding their concern and understanding for the natural areas of the campus. This started with the protection of Mystic Vale in 1993 and has continued as a result of community and student pressure to

become more environmentally sensitive. The university contracted an inventory and mapping project for the campus in 1993 and most recently in 1999 by the Westland Resource contracting group. Other projects worth mentioning include the exotic plant removal in Mystic Vale, the gradual reduction in the use of exotic plants in campus landscaping, the construction of the stairs in Mystic Vale, and the involvement of a range of Departments in the planning and development process through the Campus Development Committee. The university has recognized that there are 'unique places' on campus that should not be developed or where development should be limited (University of Victoria 1998).

However, there are many issues relating to the health, viability and ecological requirements of the natural areas of the campus that the university has not considered fully, including many of these issues that I have discussed above. A 'natural areas' policy would be particularly useful as well as a more detailed description of the siting procedure when development is planned. The Project Planning Committee for any development project on the campus are required to make "a recommendation on the siting of the project, and any other information or recommendations pertinent to the project" (University of Victoria-Policies 1973). This policy is much too vague and should be improved to incorporate environmental requirements and consequences of any development procedure. Some main recommendations regarding the future sustainability of the natural areas include the following:

1) Where possible, preserve all remaining large natural areas of the campus into an urban wildlands network. Provide buffer zones of moderate use and native plants to reduce edge effects and segregation.
2) Establish a habitat trust fund for the university lands. Encourage donations by private organizations, university alumni, community members, and the government.
3) Increase community wide education surrounding campus ecology issues to increase awareness and stewardship for these areas.
4) Increase the inventory, monitoring, and assessment of the University of Victoria lands through student and community group involvement.
5) Where possible, build up and not out, and build on concrete areas not green areas. See report by Simon Hocking (UVic Sustainability Project, 2000).
6) Improve siting procedure to consider environmental features to the maximum extent possible. Factors to consider include impervious surface coverage, impact on neighboring areas, and individual species that are impacted by development.
7) Expand exotic plant removal project to all natural areas of the campus.
8) Take a watershed approach to management hydrologic systems on campus. Conduct water quality inventory.
9) Develop a 'natural areas' policy for sustainable management of university lands.

2.1.3 The wildlife species present on campus are known, understood, studied and considered in all planning and development activities.

Rating: ★

Introduction:

The biological diversity that exists in British Columbia is the highest in Canada, yet in this province approximately 13% of vertebrate animals and 12% of vascular plants are considered threatened or endangered. The wildlife program in British Columbia, guided by the provincial wildlife strategy to 2001 works to achieve the following goals: 1) Maintain diversity and abundance of native species and habitats throughout British Columbia. 2) Provide a wide variety of opportunities for the use and enjoyment of wildlife. 3) People and wildlife living in harmony (balance between meeting the needs of wildlife and the needs of people) (Ministry of Environment Lands and Parks 2000).

The Greater Victoria area is thought to have high species diversity within British Columbia but also has many species have been impacted by urbanization and other human impacts. For example, there are 137 species of birds that overwinter in sufficient numbers to allow analysis of long-term trends, and of these species 61 have declined in abundance over the last 40 years, and 76 have increased (Capital Regional District 2000). Some species such as Canada geese and Anna's hummingbirds have benefited from human presence, and have been able to adapt to the modified environment. Other species however have suffered such as the western bluebird, which has not been observed during the Christmas Bird Count since the early 1960s.

Here on the University of Victoria campus not much long-term monitoring of vertebrate and invertebrate populations has been attempted. Necessarily, I felt that it was important to assess the status of wildlife on campus through two major objectives:

1) To the greatest extent possible, determine the species present on campus and their primary habitat requirements.
2) Determine how well the university documents, understands, and monitors the wildlife populations on campus, and assess how much wildlife concerns are addressed in planning and development initiatives.

The Bird Community of the University of Victoria:

By Paul Levesque

Introduction*:*

The University of Victoria encompasses a number of habitats that are suitable to support a relatively diverse community of birds. The wooded areas on campus include second growth Black cottonwood/ Red alder, stands of mature Garry Oak, mixed stands of deciduous and coniferous trees of varying ages, and some old growth components. The fields, buildings and small ponds on campus are also important habitats for foraging,

roosting and nesting. In the beginning of February 2000, a group of senior undergraduate students from the Biology department began to survey the bird community on the campus. The objectives were to conduct an inventory of the birds wintering in the wooded areas on campus and compare our findings to past findings of various observers. Our inventory was conducted in three ways. Firstly, the group would meet weekly in February, March and April to count the diurnal birds in the wooded areas. Secondly, the owls on campus were surveyed at night by using call play-backs. The third part of the study involved consulting with people who are frequent bird watchers, bird experts, or individuals studying bird species on the campus. The data collected in the study was then compared to historical accounts of the bird community on the campus. The final aspect of this paper is to make an assessment of the bird community on campus and to make recommendations on maintaining the community in perpetuity.

Results of the morning census:

An inventory of the bird community overwintering in the forested areas of the campus began on January 28 and was repeated every Friday morning until April 7. Stations for the survey were chosen to best represent variation in the habitats in the forested areas and to ensure that species that were present were not over looked. The surveyors spent six minutes recording the bird sightings and vocalizations. When walking between stations, birds were recorded on the incidental list. The number of stations visited on a Friday depended on the number of volunteer observers present that day; when four or more observer were present the group we would split into two groups and more stations would be surveyed.

The bird census recorded 43 species; four of these species were seen only once, flying over the forest canopy and are not regarded as part of the forest community. The most common species observed are shown in Table 1. It is interesting to note that the American Robin was the most commonly recorded species and is one of the most common prey species of Cooper's Hawks (Andrew Stewart pers. Comm.). The other most common prey species for Cooper's Hawks are European Starlings, and it would have been interesting to have placed a number of stations in the developed areas of the campus to determine how the numbers of European Starlings compared to American Robins. Of the 43 species of birds recorded on the surveys, 37 of these are directly dependent on forests for nesting, foraging and roosting. The overall species list of all species observed in the survey, as well as any additional species currently present on campus, and historical bird presence on campus can be seen in Appendix 4.

Cooper's Hawks:

The breeding population of Cooper's Hawk on campus is one of the most extensively studied bird populations on campus. Since 1994, Andrew Stewart has been studying the breeding ecology of the urban nesting Cooper's Hawk in the Greater Victoria area. As part of this study Stewart has located and monitored 15 nests on the campus (see Table 2). Many of the Cooper's Hawks on the campus and the Victoria area have been banded with colored leg bands to mark individual birds. The banding of the hawks has provided insight to mate fidelity, nest site fidelity, age and dispersal. The 1999 breeding season saw four nesting pairs of Cooper's Hawks on campus. These pairs produced 10 chicks, and marks one of the highest nesting densities ever recorded. As of this writing, three

pairs of Cooper's Hawks are courting and building nests in the forested areas of the campus, including nests in Bowker Creek, the South Woods and Mystic Vale.

Table 1. The most commonly recorded bird species during the winter songbird survey in the wooded areas of campus.

Rank	Species	Number of detections
1	American Robin	161
2	Chestnut-backed Chickadee	145
3	Pine Siskin	104
4	Winter Wren	93
5	House Finch	92
6	Dark-eyed Junco	70
7	Golden-crowned Kinglet	63
8	Spotted Towhee	51
9	Red-breasted Nuthatch	50
10	Red Crossbill	40

Table 2. The known nesting sites and density of Cooper's Hawks on the University of Victoria campus.

Year	Known # of nests	General location on campus
1993	One	West of Begbie building
1994	One	West of Begbie building
1995	One	West of Begbie
1996	Two	1.West of Begbie 2.Mystic Vale
1997	Three	1.West of Begbie 2. Mystic Vale 3. Cedar Hill Cross Rd.
1998	Three	1.West of Begbie 2. Mystic Vale 3. Cedar Hill Cross Rd.
1999	Four	1. West of Begbie 2.Mystic Vale 3.South entrance 4.Near Cunningham

Owls:

The Western Screech-Owl *Otus kennicotti saturatus* has been recorded on the campus by Tatum (1970) and documented by Fraser (pers. Comm.) in 1979 and 1980. In 1979 Fraser recorded 13 breeding pairs on campus and a breeding pair in Mt. Tolmie Park that frequently foraged on the campus. The following year Fraser found 8 breeding pairs of Western Screech Owls on the campus. In the late nineties the general consensus among the birding community in Victoria was that the Western Screech Owl was now "gone" from the University campus. It was decided in early February of 2000, that an inventory of the campus owl community should be conducted, with a focus on determining the present status of the Western Screech Owl.

The owl survey methodology involved determining suitable survey sites, and then visiting these sites and playing pre-recorded owl vocalizations on a small portable tape player. The survey sites were positioned 300-400 meters apart to ensure complete coverage of the area. The survey at each station began with a five minute period of listening for calling birds, then the playing of 5-7 calls of the target species, and followed by a five minute period of listening for responses. This period was then followed by playing a further 5-7 calls and then a final five minute listening period. Once the presence of an owl was determined in an area either during the owl survey or during the morning surveys, the playing of vocalizations of that species was discontinued to reduce any unnecessary harassment of the owls. Five owl surveys were conducted: February 17, 24, March 7, 14, and April 3. The timing of the surveys and the dates were chosen to coincide with the known breeding period (Campbell et al. 1990). The surveys were conducted on dry evenings and if it started to rain during a survey the owl survey would be cancelled and resumed on a more suitable evening.

Western Screech-Owl:
The *Saturatus* subspecies that occupies Vancouver Island is currently listed on the Ministry of Environment, Lands and Park's blue list. As previously stated the campus once supported a high density of Western Screech Owls. Over the course of the five evening owl surveys, 16 hours and 48 minutes of observer hours were spent trying to detect Western Screech Owls, and no detections were obtained. The methods and observers ability to detect this species was tested on two evenings where surveys were conducted at known nest sites in Mount Work and Durance Lake Regional Parks. On March 7 after surveying the University campus the survey team detected two Western Screech Owls and two Northern Saw-whet Owls at Mount Work. On April 3 the survey team again detected Western Screech Owls and Northern Saw-whet Owls at Mount Work and Durance Lake, before completing the owl survey at the University campus. Due to the lack of response to the vocalizations, it is the opinion of the author that the Western Screech Owl is no longer present on the University of Victoria campus.

Fraser noted that the arrival of the Barred Owl coincided with the decline of the Western Screech Owls on campus. On 11.2% of the surveys where Western Screech-Owl vocalizations were played, Barred Owls were observed flying silently into the survey area. The Barred Owls would then make one or more passes at the tape player, sometimes within two meters of the observers. On one occasion a Barred owl repeatedly made passes at the tape player as the Western Screech-Owl calls were played. This behavior appeared to be aggressive and it is likely that the much larger Barred Owl has played a role in the decline of the Western Screech-Owl on campus and elsewhere.

Barred Owls:
The Barred Owl is a forest dwelling bird, that resembles the Spotted Owl, and it should not be confused with the Barn Owl that is light in color and frequents barns. The Barred Owl is a newcomer to the bird community of B.C. and the campus. Rand (1944) first reported this species in B.C. in 1943 at Liard River and in 26 years the species had expanded it's range south to Victoria, being first observed by Stirling (1970) on November 26, 1969. Barred Owls were first seen on the university campus by Fraser in

1980 and are now seen commonly by the author. This species has been very successful in B.C. and this type of range expansion can not occur without some impact on the other species present. The morning songbird surveys detected Barred Owls calling on two separate mornings, and during the owl surveys they were detected repeatedly. It is believed that at least one pair of Barred Owls is nesting on campus this spring, but at this time no nests have been observed.

Great Horned Owl:
Great Horned Owls are regularly seen on campus throughout the year, most often at dusk, hunting rabbits from the roof of the Elliot Building. Fraser first recorded this species in 1981, and their arrival coincided with the introduction of rabbits to the campus. Great Horned Owls have nested in years past, but do not appear to be nesting on campus this spring. There is some evidence that the pair on campus was to nest this year but was stopped by unidentified factors. In January and early February there were a number of reports of two Great Horned Owls calling in the morning in Mystic Vale. In late February an adult Great Horned owl was seen being mobbed by a flock of Northwestern Crows and the following day eggshell fragments were found. The shell fragments were never confirmed to be that of a Great Horned Owl, but they did fit their description. The owls were not detected after this time on the owl surveys or during the day. On April 11, the remains of an adult Great Horned Owl were found in Mystic Vale; the owl had been dead for some time.

Woodpeckers:
Four species of woodpeckers are regularly found on the campus: Northern Flickers, Downy Woodpeckers, Hairy Woodpeckers and Piloted Woodpeckers. These four species play an important role in the bird community on campus. A number of bird species on campus are secondary cavity nesters or are weak excavators, and rely on the abandoned cavities created by the woodpeckers. These cavities are generally found in older trees, dead limbs or snags, and vary in size according to the species that excavated the cavity. The woodpeckers rely on these trees for food; the softer bark of dead or dying trees is more accessible for insects to bore into and thus provides woodpeckers with a rich food resource. From observations made during the morning bird surveys, it appears that at least one pair of Piloted Woodpeckers, at least three pairs of Downy Woodpeckers, a single pair of Hairy Woodpeckers, and at least one pair of Northern Flickers are attempting to nest on the campus in the spring of 2000. If snags and dead limbs are removed from campus the population of woodpeckers will likely decline, and there will be a subsequent decline in the species that rely on the woodpecker excavations for breeding and foraging.

Discussion:
The knowledge of the bird community on the University of Victoria is for the most part, lacking. There have been a few studies spanning short periods of time, and still no long-term monitoring efforts following bird populations on-campus. There is little known about the breeding species and the size of the various populations, and thus it is very difficult to make any type of management decisions that may or may not affect these species. It is also not possible to make any comparisons with the morning bird surveys to see what populations are increasing, decreasing or stable. At this point in time if a species was in serious decline on campus, it could easily go unnoticed until it was too late.

Tatum's investigation in 1970 is now an important milestone in understanding the changes that have taken place in the bird community in the past three decades. Tatum made reference to four species that were thought to be in serious decline, Skylarks, Western Meadowlarks, Common Nighthawks and Savannah Sparrows. The first three species have not been recorded in the nineties, and the Savannah Sparrow has not been seen in a number of years. Tatum goes on to mention other species like Black-bellied Plovers: "At high tide, 100-200 habitually rest and feed on the playing fields, especially when wet". He also describes Dunlins: "Winter visitor. A shorebird often seen on the playing fields in flocks of up to 500 at high tide". The author has seen neither of these species on the campus in the past four years, but more importantly, flocks of this size for these two species are seldom, if ever seen presently in the Victoria area. There are at least another 20 species that Tatum lists as "common", "breeding" or "uncommon" that are now never or rarely seen on the campus. The loss of 24 species of birds in thirty years is alarming.

It is regrettable that a more active role in bird conservation has not been undertaken on the campus. The bird community on the campus is of value to the university and to the community as a whole. An example of a direct value is the role that raptors play in controlling the rabbit population, thus helping the university to avoid a controversial rabbit cull program. An indirect value that birds provide is the sense of uniqueness and beauty that is so often seen as one of the benefits of attending the University of Victoria, a value that is difficult to measure by economic standards.

Although the University's purpose is to be an educational institution and not a nature conservation area, it is possible to have both. The University is blessed with a resource that other businesses and other institutions will likely never have - knowledgeable and enlightened people. The University could play an important role in bird conservation by changing a number of practices and introducing some programs.

1) The forested areas on campus are under siege by introduced plant species, the most serious being English Ivy. In many areas Ivy is now the dominant ground cover and appears to be suppressing the rate of tree recruitment. This is a slow death for a forest that is relied upon by so many species. A management plan needs to be developed to confirm the impact of these exotic species and to safeguard the integrity of the forests. The problem of exotic species is not unique to the campus and is a serious problem in all areas of southern Vancouver Island.
2) The removal of dead standing wood should be kept to an absolute minimum, due to its importance in the lifecycle of a number of species and due to its relative scarcity in the urban environment. The snags found in Mystic Vale and else where on the campus are some of the only examples of dead standing wood for kilometers in the Greater Victoria area.
3) The University should make a greater commitment to monitor the bird populations on campus. This monitoring should be well

planned, standardized and conducted in a continuous and ongoing manner for a goal of long-term conservation. This type of monitoring would be able to identify species that are in decline and identify possible reasons for the decline. Having this type of knowledge is critical to eliminating the current rate of species loss the University is experiencing. The Biology department could play a greater role in this part, but should not be held responsible for all of the wildlife management on campus without increasing the resources to the department.

4) A checklist of the bird species on campus could be useful in increasing the awareness of the biological diversity present. Checklists are common for various regions like parks or cities, and the total species list is often seen as an indicator of the area's uniqueness.

Other Wildlife Species on the UVic Campus:

The population status and distribution of other vertebrate and invertebrate species found on the University of Victoria campus is largely unknown at this time due to lack of study. Assessment of wildlife species present on campus was largely obtained from personal observations, interviews with knowledgeable individuals on campus, and review of the Westland Resource Group inventory (1993).

There is most likely a significant population of rodents on campus possibly consisting of the House mouse, the Deer mouse, the Norway rat, and even some shrew or vole species (Winchester 2000). This is known through the personal observations of owl pellets that contain small mammal skulls on campus. However, their population levels and the interactions between native and exotic rodent species are not known. Other mammal species present on campus include raccoons, Black-tailed deer, Grey Squirrels, and the European cottontail. The presence of the Grey squirrel is significant because it is one of the major factors in the elimination of the Red squirrel, formerly native to this region.

Of the native reptiles there are potentially two species of Garter snake on campus (*Thamnophis ordinoides* and *T. elegans*), but their presence has not been documented for several years (Gregory 2000). There are also introduced Painted turtles (*Chrysemys picta*) in the pond adjacent to the Cunningham building. The presence of amphibians on campus is currently completely unknown (Davis 2000). However, there are potentially Western red-backed salamanders (*Plethodon vehiculum*) and Rough-skinned newts (*Taricha granulosa*) that occur on campus. Also, there are many invertebrate species on campus including potentially rare species that have never been documented.

Discussion:

As a result of the low amount of knowledge regarding the vertebrate species that utilize the natural areas of the campus, there has been a subsequent lack of consideration for these species on the part of the university in the planning and development process. This is in stark contrast to the extensive inventory of the University of British Columbia

Endowment lands where the abundance, habitat and general Biology of the vertebrate species present in this area has been conducted (Newell 1983). It is apparent through the discussion by Tatum et al. (1971) that the University of Victoria used to be a much different place for wildlife, even just twenty years ago. The loss of 24 bird species in that time is significant and alarming, and is indicative of more to come if policies are not changed and awareness does not increase. Gregory (2000) mentioned that Garter snakes (*Thamnophis* sp.) used to be present on campus but may not be at this time as a result of the lack of grassland habitat that is not subject to mowing. Even though the presence of the Barred Owl likely contributed greatly to the elimination of the Western Screech Owl on campus, there was a lack of consideration for critical nesting habitat by the university. Most likely a combination of these two factors resulted in the extirpation of this rare owl from the campus. A species inventory of the campus to determine present wildlife populations followed by a habitat requirement assessment for these species is surely needed at this time.

Probably the most ecologically valuable species still present in the campus area include the top-level bird predators namely the Cooper's Hawk, Barred Owl, and Great-Horned Owl. The presence of these species indicates a sufficient prey base of small mammals and birds, which correspondingly feed on insects and vegetation. The main prey species of the Cooper's Hawks are in fact common city birds, and their main habitat requirement involves a patch of large trees for nesting (Stewart 2000). Owls on the other hand feed primarily on small mammals and require a moderate sized forested area for nesting, roosting and foraging. The university should take the appropriate steps to ensure that these species are protected. If this occurs then many other species will be subsequently protected. However, some species such as ground nesting birds and Garter snakes, or amphibians require specific habitats not necessarily covered by the top predators. These include the grasslands and wetlands of the University of Victoria campus, which are subject to restoration possibilities. Several recommendations to improve conditions and value for wildlife on campus, which are an extension of the discussion by Paul Levesque above, include the following:

1) The university should strive to inventory and monitor all of the wildlife species to form a wildlife checklist for the campus. This need not be accomplished solely through independent contractors when student and faculty resources are available through various departments. If long-term assessment is established then trends in species abundance can be determined and predicted.
2) Establishment of the key habitat requirements of species present on campus should be conducted prior to any further development in or around the natural areas. Rare or endangered species that are found should be even more rigorously studied. Reduction and degradation of these habitat requirements should be prevented.
3) Possible restoration and reintroduction of certain habitats and species on campus, conducted through the Environmental Restoration Program, interested departments and community members.

4) Education of the university community regarding wildlife conservation issues.

2.1.4 The value to humans of the natural aspects of the UVic campus are known, recognized, fostered, and considered in all planning and development activities.

Rating: ★★★☆☆

Introduction:

Public awareness towards environmental issues have increased on campus since the acquisition of the University of Victoria Gordon head lands in the 1960's (University of Victoria 1998). However, to my knowledge not much work has been done to formally document the values that the university community has for the campus environment. The only work that I am aware of for the Victoria campus involves work done by the Trillium project and published by Taves (1994).

Biological diversity and intact habitats can be divided into their instrumental (or utilitarian) and intrinsic (or inherent) values based on their various attributes (Meffe & Carroll 1997). Instrumental values are considered as the anthropocentric human benefits from natural environments such as products and goods, ecological services, information and education, and spiritual guidance. Intrinsic values are generally more difficult to define and consist of an environment or ecological process that has inherent value in itself beyond the utility to humans. This section focuses on determining the instrumental values of the university lands, as well as the degree of both instrumental and intrinsic values of the natural areas to university students.

To address the issue of the value to humans of the natural aspects of the University of Victoria campus I asked myself three main questions that became the objectives of this section.

1) Other than their ecological values, what values do these natural areas of the campus possess?
2) How do students currently feel regarding campus ecology issues and how highly do they value these areas as they presently exist?
3) How well is the university incorporating these community values into a formal policy on planning and development on the campus?

To accomplish these objectives I incorporated direct research and interviews with various individuals with a questionnaire survey of student values.

Results of the Survey:

In general, the number of students that responded to the survey in each faculty coincided with the actual distribution of students per faculty (Figure 1). The main exception involved the faculty of Graduate Studies where response to questionnaires left in student boxes was very low. This is unfortunate and may have contributed to a slight bias in the

results. Also, due to time constraints most faculties were not sampled to the degree that was originally intended and a total sample size of 396 questionnaires was completed. However, this was still a considerable sample size, sufficient to demonstrate certain values of the student body.

In question 1 of the survey it was found that only 6.8% of respondents use the natural areas frequently, with 52.7% indicating they use the areas sometimes, and 40.5% indicating that they never use these areas (Figure 2). When asked in what ways they use the natural areas the majority responded to 'observe/ enjoy nature' (50.6%), while 41.3% stated that they use the areas to 'exercise/ play', and 19.0% use the areas as a part of course requirements (Figure 3). 10.1% of respondents indicated other uses for the natural areas of the campus which included some interesting responses. Several people indicated that they use the areas to read, meditate, relax, do photography, walk their dog, eat lunch or just keep their mind off of their studies. Others replied that they 'smoke pot', 'make out' or go on 'shroom trips' in the natural areas, and one person said that 'you just don't want to know.'

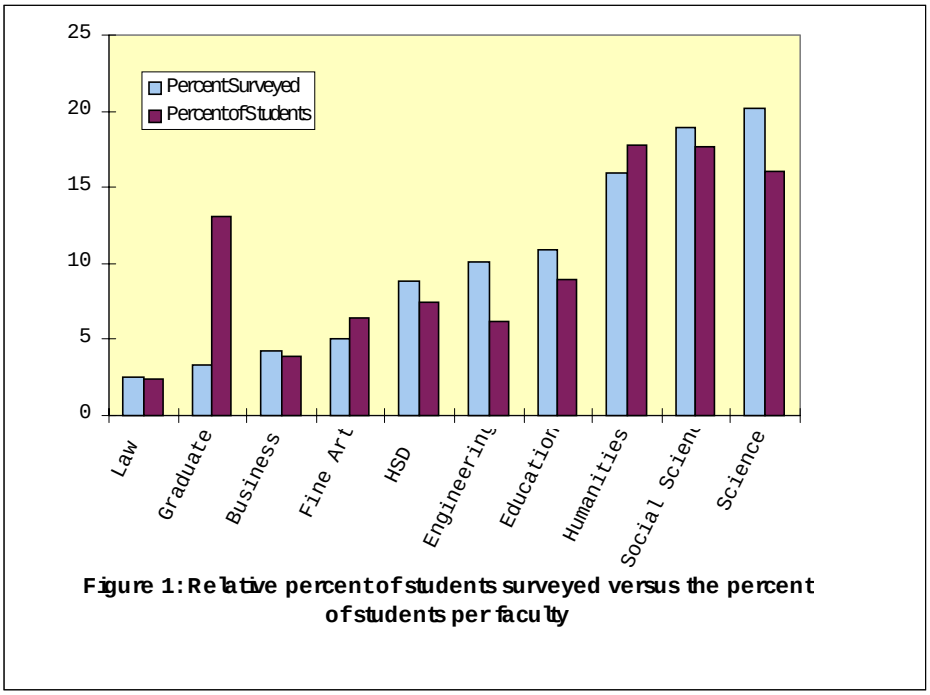


Figure 1: Relative percent of students surveyed versus the percent of students per faculty

Interestingly, when asked if they are aware of the Garry Oak meadow on the UVic campus only 25% of students said 'yes' and 75% said 'no' (Figure 4). However, when asked if they would be concerned about it if they knew it was rare in the Victoria area 79.4% said 'yes' (Figure 5). Only 28.2% of students felt concerned about the use of non-native plants in campus landscaping, with 44.0% indicating that they were not concerned

(Figure 6). There were a high number of respondents who indicated ‘don’t know’ in this question (27.7%). When asked if they would visit the areas more if there were birds of prey nesting in them 43.6% of students said ‘yes’, while 33.7% said ‘no’ and 22.7% indicated ‘don’t know’ (Figure 7). Of the students that said ‘no’ several indicated that this was because they didn’t want to disturb the birds or have any adverse impacts by using the areas. There was high support for further integration of the natural areas into university curricula and activities (75.0%) (Figure 8) and for environmental impact assessments when development is planned for any area of the campus (85.5%) (Figure 9). When asked to consider the value of the natural areas as they presently exist considering their potential for other uses 61.4% responded ‘high value’, 35.5% indicated ‘value somewhat’ and only 3.1% said ‘low value’ (Figure 10).

When student values towards the natural areas on campus are assessed in greater depth, some interesting trends emerge. Student values for maintaining intact habitats on campus in the faculties of Engineering, Business and Law were the lowest, while Fine Arts and Graduate students had the highest value for maintaining these habitats intact (Figure 11). Students in other faculties were found to have intermediate values for the natural areas. In general though, the mean value for the natural areas in all faculties was quite high and the difference between most of them was not great.

Students that were aware of the Garry Oak meadow on the university campus were found to exhibit a generally higher value (on average) towards the natural areas of the campus (Figure 12), and used the areas more frequently (Figure 13). Higher value of the natural areas of the campus also corresponded to an increase in the frequency of use of these areas (Figure 14). Thus the frequency of use of the natural areas, awareness of the Garry Oak ecosystem on campus, and the corresponding high student value for an intact university environment were found to be related.

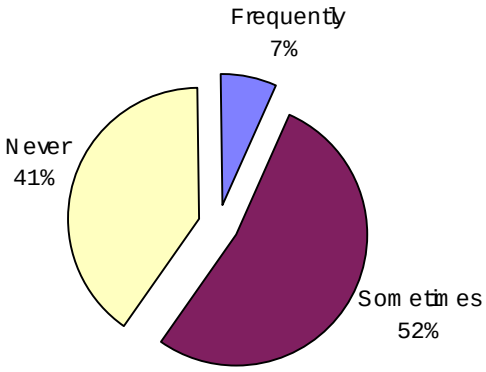


Figure 2: Frequency of use of natural areas by all students (Question 1)

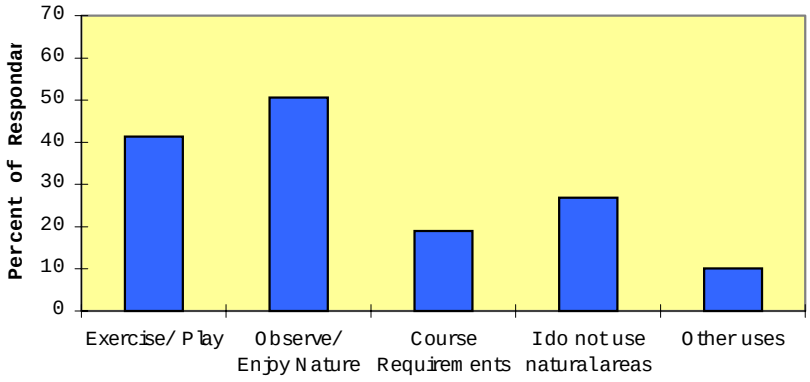


Figure 3: The ways that students use the natural areas on the UVic campus (Question 2)

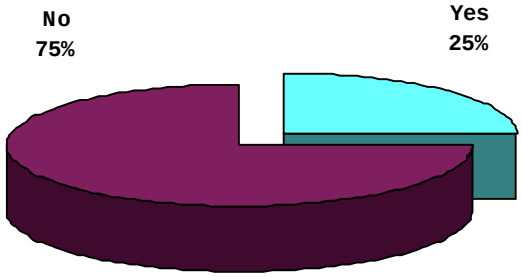


Figure 4: Student awareness of the Garry Oak meadow on the UVic campus (Question 3)

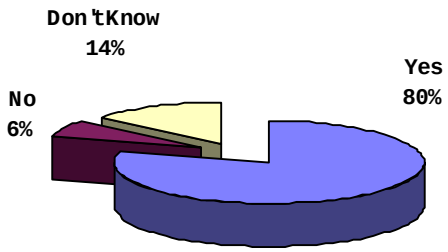


Figure 5: Student concern for the Garry Oak meadow if knowledge of its rarity is known (Question 4)

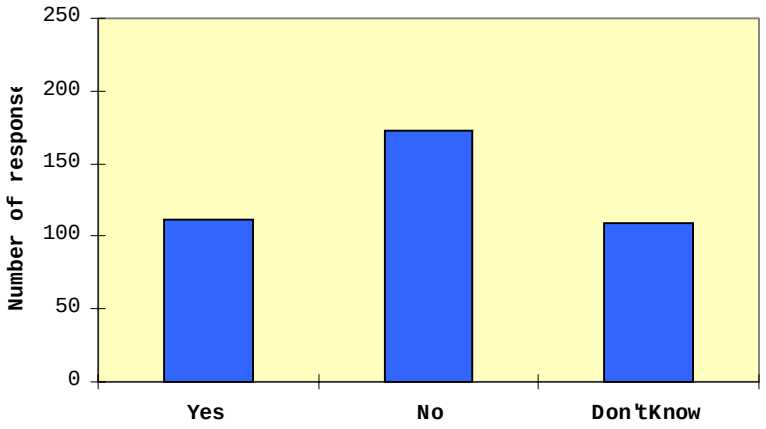


Figure 6: Student concern for the use of non-native plants in campus landscaping (Question 5)

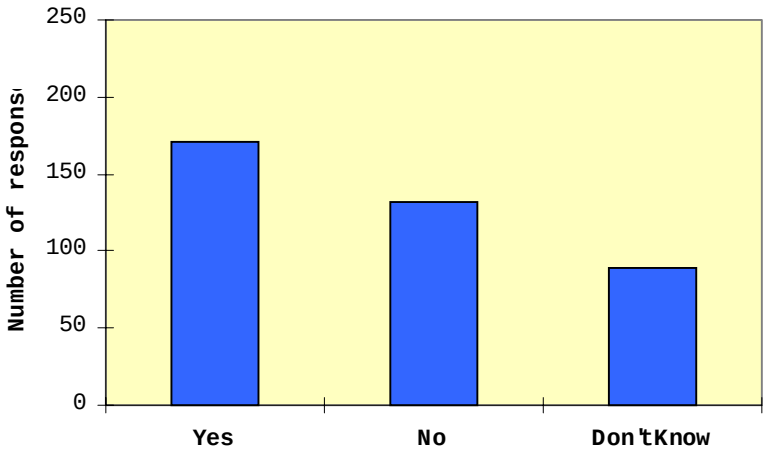


Figure 7: If there were owls, Bald eagles, and other birds of prey nesting in the natural areas on campus, would you visit these areas more? (Question 6)

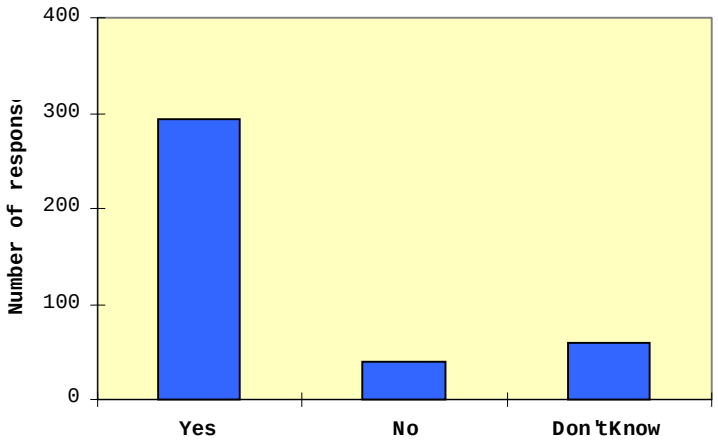


Figure 8: Student support for greater integration of the natural areas on campus into University curricula and activities (Question 7)

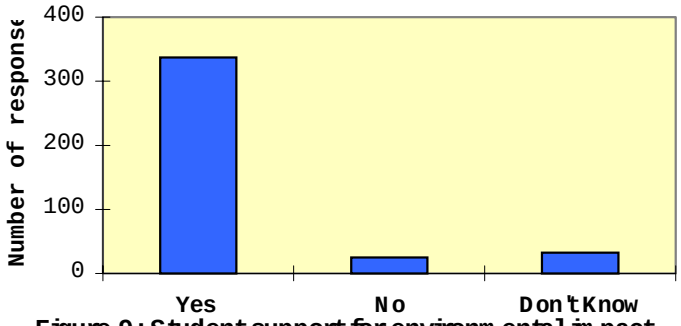


Figure 9: Student support for environmental impact assessments when development is planned in any area of the campus (Question 8)

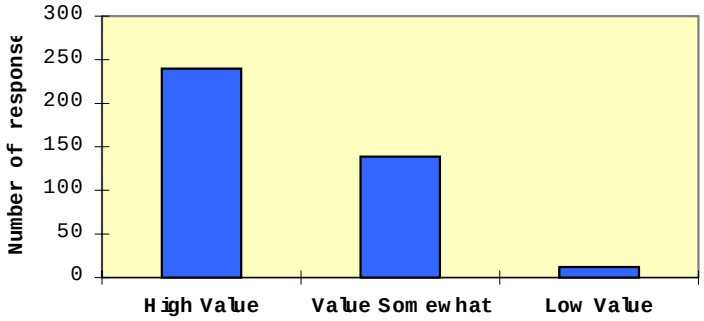


Figure 10: Student values for the continued existence of the forested areas on campus given their potential for other uses (Question 9)

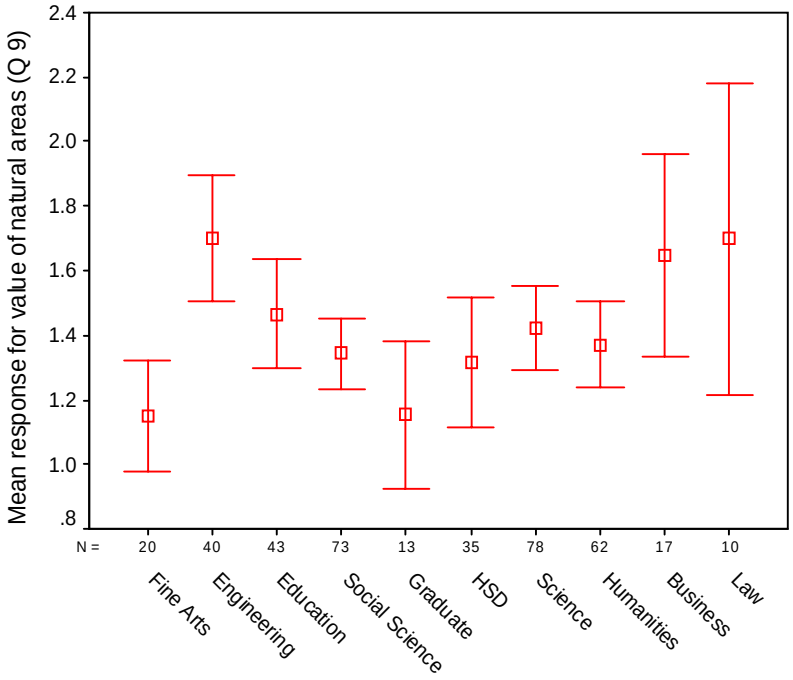
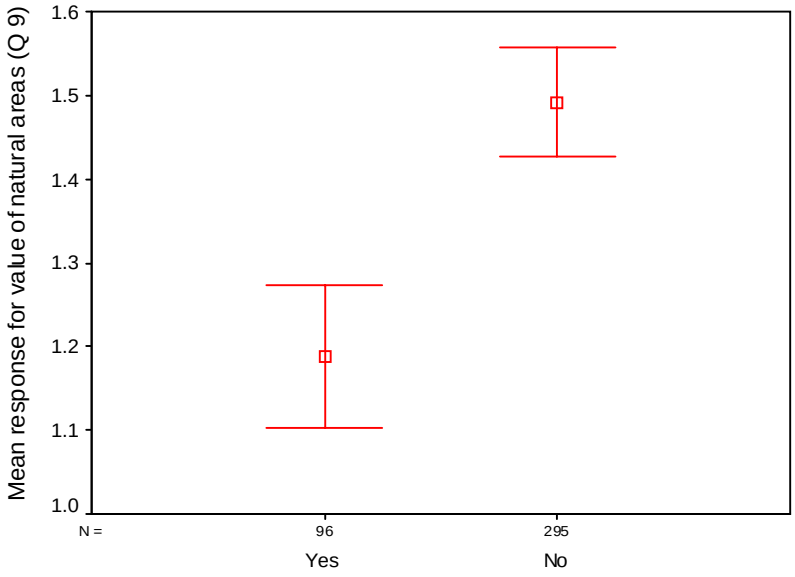


Figure 11: 95% confidence intervals for the mean student values associated with the natural areas on campus for each faculty. Where 1= 'high value'; 2= 'value somewhat'; 3= 'low value'.



Question 3: Awareness of Garry Oak

Figure 12: 95% confidence intervals for the mean student values associated with the natural areas on campus given their awareness of the Garry Oak (Question 3). Where 1= 'high value'; 2= 'value somewhat'; 3= 'low value'.

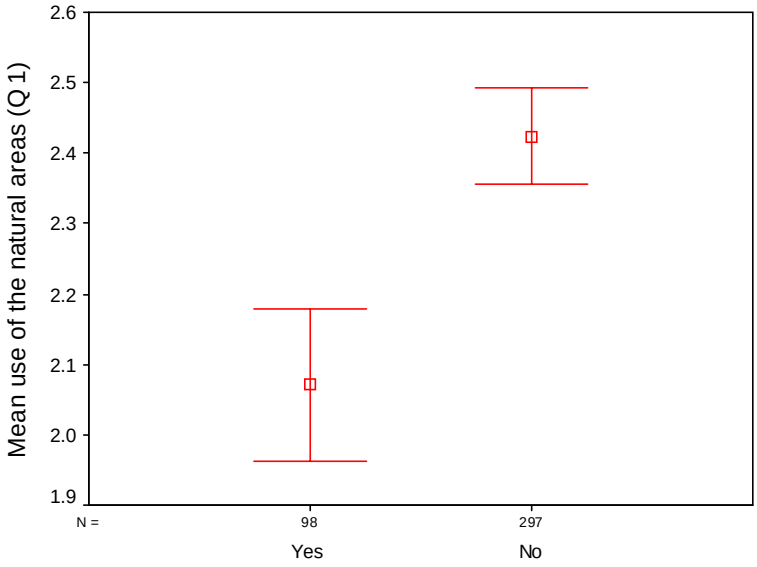


Figure 13: 95% confidence intervals for the mean frequency of student use of the natural areas on campus given their awareness of Garry Oak (Question 3). Where 1= 'frequently'; 2= 'sometimes'; 3= 'never'.

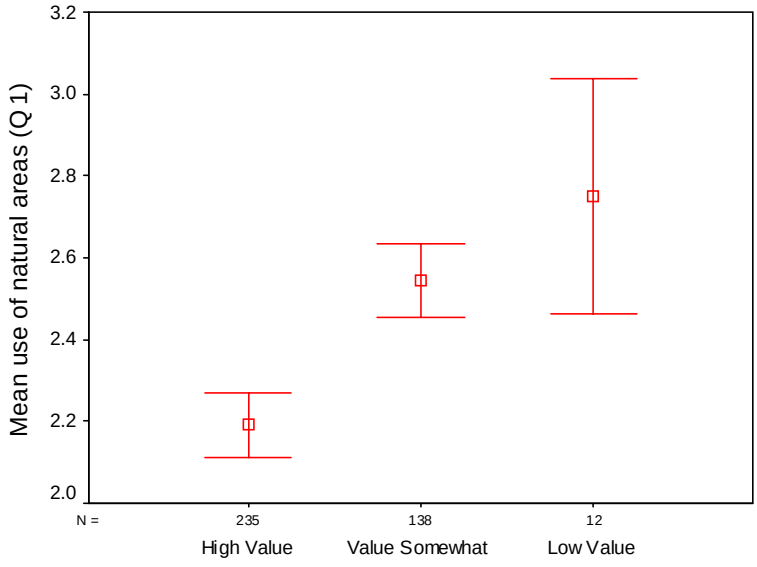


Figure 14: 95% confidence intervals for the mean frequency of student use of the natural areas on campus given their value associated (Question 9). Where 1= 'frequently'; 2= 'sometimes'; 3= 'never'.

Discussion:

There have been significant changes in awareness and attitudes towards environmental issues since the founding of the University in the 1960's (University of Victoria 1998). However, to my knowledge, there has been little done by the university to document these changes in beliefs through research into student values. A project done by Lana Taves through the Trillium project in 1994 is the only one that I know of to date. In her report she found very high concern and support for native plant issues, restoration on campus, environmental impact assessments, and further integration of the natural areas into university curricula and activities (Taves 1994). She also found that students and community members used the areas more frequently that what I have found in my survey. Taves (1994) found that only 14% of respondents never use the natural areas while I found that 40% never use these areas. Though the results of Taves (1994) demonstrate active sentiments of some members of the university community, I do not believe them to be representative of the community as a whole. Since Taves did not get complete return of the questionnaire, and in some cases it was actually very low, those that did respond may have been more partial to environmental issues, and thus introduced a large bias. As a result, I feel that our sampling methodology was much more rigorous and should roughly represent student views on campus as a whole. The main bias in our survey resulted from our sampling of graduate students in which there was a small selective response. However, the contribution to total response is quite insignificant given the low graduate numbers, indicating that the questionnaire is much more of a reflection of undergraduate student values and attitudes.

As revealed in the results of the questionnaire there are diverse physical health, social, spiritual and educational values and uses by humans for the natural areas of the University of Victoria campus. These responses indicate that the natural areas of the campus are highly valued. This is in spite of the fact that only 25% of students were found to be aware of the Garry Oak community on campus, and that there is no current map or university produced brochure on the natural areas that is commonly available to students. I conclude that the overall sentiment towards protecting the integrity of the natural areas on campus by students is high despite the moderate amount of information available. Many students seem to appreciate the natural areas of the campus beyond their practical applications or economic potential, and instead simply for their intrinsic worth. Furthermore, greater than 40% of respondents stated that they used the natural areas to exercise or play and 19% of students responded that they used the natural areas as a part

of course requirements. This suggests a reasonably high instrumental worth of the natural areas.

It is interesting to note quite a significant discrepancy between the data of Taves (1994) and myself on the subject of native versus exotic plants in campus landscaping. In 1994 92% of respondents thought that at least one half or greater of the plants in campus landscaping should be composed of natives. In my survey only 28% of students were concerned about the use of non-natives, while 44% were not concerned, and another 28% didn't know. The large difference is most likely due to the introduced bias in the survey of Taves (1994), but also may be a reflection of increased university performance and movement on this issue reducing the need for student pressure.

Interestingly, the frequency of use, the awareness of Garry Oak ecosystems, and the value for the natural areas were found to be positively correlated. Increased awareness was found to translate into increased frequency of use and a higher value for maintaining these areas intact. Due to this finding, which is rather intuitive anyway, you might expect that increased publicity and education of the student body regarding the diverse values of the natural areas of the campus (and even just their presence!) would translate into increased student use and higher student values for these habitats. Increased frequency of use could possibly have some negative effects such as disturbance to the habitat. However, appropriate education regarding the issues of sensitivity of habitats and wildlife could be easily accomplished. Increasing the awareness of the diverse values for the natural environments on the University of Victoria campus allows for university community members to have much more of a connection to the region in which they live and/or study. Increased awareness by students of this relationship has many hidden benefits that extend far beyond the reach of the University into our daily activities and consumption patterns.

So why have I given the University of Victoria a 3 out of 5 for their consideration of human valuation of the natural areas? Well, I find that the university has taken some important steps in considering student and community values towards the natural areas and issues of sustainability in general. The university has made a commitment to preserving at least some of the natural areas on UVic lands through the purchase of Mystic Vale and Haro Woods, the former acquisition being a result of public pressure. Furthermore, the university has implemented an ivy removal program in Mystic Vale and is starting to change its policies regarding native plant issues on campus (James 2000). There is currently a Campus Development Committee (CDC) that is composed of students, academics, facilities managers and administrators that meet to discuss potential development initiatives and concerns. The university itself has stated: "The original campus plan envisioned relatively uniform development over the entire campus area. Since that time, environmental concerns at the university and in society in general have greatly increased. Today, the university community recognizes that "there are some areas on campus which should not be developed…"

However, there have been many development projects in the past that have failed to consider all of the human and natural values for a given project resulting in some displeasure and disgust. A commonly cited example is the recently constructed Center for

Innovative Teaching which was designed quite poorly in regards to the high land surface area occupied compared to the useable space for teaching and research. Some environmental values such as the removal of the Garry Oak were also not considered. In fairness to the university, there is often poor participation in open public forums for comments, discussion and debates on planning and development issues leaving the university with no grounds for re-assessment.

So how can the university improve in this area? Well this is a difficult question when considering that there are many diverse human values and goals that the university attempts to represent. As a result, I can pose several questions that lead into the remaining sections of the report:

1) Are all views and perspectives of the UVic community getting proper representation within the Campus Development Committee and how much are these collective views being considered by the lead planner during development?
2) Are there appropriate lines of communication between members of the CDC, other faculty, community members, and the student body?
3) Is there sufficient advertising and awareness generated for the open public forums regarding campus development issues?
4) Is there sufficient promotion of awareness for campus ecology issues in the university community in general and how can the university improve?

2.1.5 There is a consistent effort on the part of the University to determine potential restoration and improvement projects in the natural areas of the campus.

Rating: ★★★☆☆

Discussion:

The university has begun to become more involved in the process of restoration on campus. Several years ago, stairs were built into Mystic Vale near parking lot 1 in response to high public use that was resulting in significant bank erosion. The university has also started to use more native plants in campus landscaping and has begun an exotic species removal project in Mystic Vale (James 2000). All of these projects, in conjunction with a gradual recognition by the university towards environmental stewardship, have contributed to an improvement in the health and stability of the UVic landscape. However, there is much work to be done.

There are many projects that could be conducted by the university and by students that could further improve the environment of the campus. Many of these projects, such as the construction of stairs up the opposite bank of Mystic Vale, have been recognized by Facilities Management but have not started due to a lack of funding (James 2000). This tells me that the university has not committed to restoring and improving the environmental qualities of the campus to the maximum extent possible. An infusion of funds to prevent excessive erosion on the far bank of Mystic Vale is absolutely necessary

at this time. However, increasing the funding to projects such as this is not always the answer. For instance, the exotic plant removal in Mystic Vale is a difficult and expensive project that needs to be expanded to the rest of the campus. This cannot be accomplished with the given resources and funds available, and as such needs to be expanded to include class projects, concerned students, and community members. As I mentioned previously, these groups are an untapped resource that should be utilized to the maximum extent. If the university truly cares about the environment of the campus then there should be a way for them to circumvent the issues of volunteer safety and worker's union concerns.

A main project that has not received much consideration by the university is the restoration of the Garry Oak meadow, arguably the most valuable habitat remnant on campus. The dumping of excessive amounts of soil during the construction of facilities for the Commonwealth Games resulted in a significant decrease in valuable plants native to this area (Turner 2000). Presently, there are still many valuable native plants apart from the Garry Oaks but improvement is still necessary. I presented several recommendations regarding the restoration of the Garry Oak in the previous discussion of this area, with the most feasible seeming to involve mechanical restoration. This could consist of removing exotic plant species, encouraging the establishment of young oaks, and planting a mix of native plants, and could be easily accomplished by different community and student groups coordinated through the university. Several other restoration and improvement projects include:

1) Wetland restoration in Mystic Vale and Bowker Creek. This could involve the reintroduction of amphibians and some invertebrates native to the region, as well as planting native plants that do well in moist habitats.
2) Continued reduction in the use of pesticides and herbicides that contaminate university watersheds.
3) Continued planting of more native plants throughout the campus coinciding with the removal of exotics. This could include planting of native trees in the forested areas where recruitment is limited due to exotic plant disturbance.
4) Restoration of native grasslands in certain areas subject to mowing. This could involve the designation of certain areas for limited management coinciding with the reintroduction of Garter snakes and other wildlife that require longer grasses for foraging and concealment. Grasslands are essential and diverse ecosystems as well and are not often considered as highly as they should. Restoration of some components within the 'land bank' beyond Mystic Vale is a possibility.

2.1.6 There is a consistent effort on behalf of the University to make the landscaped areas of the campus mimic the natural surroundings of the campus and/or to model the historic ecosystem type and function.

Rating: ★★★

Discussion

This section centers around the University of Victoria's Landscape Concept, a policy developed in 1974, which provides the basis for the location and types of plants to be planted, the appropriate circulation routes, and the overall character of the campus. Furthermore, without a formal 'Natural Areas Policy', this concept provides the backbone from which the university manages the remnant natural areas on campus.

To the credit of the university they have emphasized the planting of native plants on campus particularly in the transition between natural and more formal landscapes. The landscape concept states that the university will "continue the natural plant materials of the site, rather than to encourage exotic, imposed materials" (University of Victoria- Policies 1974). However, there has been some significant planting of exotic plants in the formal landscapes, including ground cover such as English Ivy, which has unfortunately spread into the natural areas at the detriment to the university. Under increased pressure from students in the last few years for a reduction in the use of exotic species the university has begun to respond and now no longer plants ivy as a component of the landscaping (James 2000). In general the university has started to improve in recent years regarding the exotic plant issue reflected in the ivy removal project in Mystic Vale and the increase in planting of native plants inside Ring Road.

Despite these positive steps, the overall goal of the landscaping seems to center much more highly around the visual continuity of the campus rather than the ecological benefits for the continued planting of native plants. This is reflected in the three major functions of the landscaping which refer to the importance of the continuity of the landscape, the visual appearance of the campus, and orderly circulation routes. This is in contrast to the minor function which states that an inventory of botanic materials for educational purposes and the preservation of the natural ecology of the campus are of concern (University of Victoria- Policies 1974). This indicates an overall value towards display and appearance of the campus over the ecological content. These sentiments are again revealed in the Campus Plan Update 1998 where the location of several natural areas at prominent locations of the university is thought to be more of a deterrent to development than the actual ecological and other values that the natural areas possess. By saying this I do not mean to say that the visual appearance of a forest is of no importance, but that the myriad of other values have seemingly been underestimated and overlooked. Of particular mention includes consideration for the wildlife species that are never mentioned at any point within the landscape concept. The result of this devaluation of the wildlife species has been a significant reduction in diversity on campus in the last 40 years, a situation that is regrettable and could have been reduced with more rigorous consideration for these species through appropriate planning and siting.

The landscape concept of the university states "that the natural areas be preserved as long as possible and…the final concept is defined in terms of trees and lawns" (University of Victoria- Policies 1974). This statement basically summarizes the active sentiments of the university for long-term planning within the natural areas of the campus. This idea that the values of the natural areas are important yet secondary to the formal appearance and mission of the university is prevalent throughout university policy and planning principles. This is unfortunate and will result in the continued gradual reduction of natural

habitats on campus, a situation that would further degrade areas such as Mystic Vale that already have been protected but depend on adjacent areas of intact habitat as buffers and as sources of gene flow. In this context I would further recommend that a 'Natural Areas Policy' be developed so that all of the values that I have mentioned above are appropriately considered and incorporated into a more reasonable and sustainable landscape plan.

2.1.7 The University assesses, documents, monitors, reviews and communicates the changing state of the natural areas on campus over time in order to adapt to and effectively manage these areas. Rating: ★★

Discussion:

Out of all of the sections that I had to assess, I found that this section was the hardest to place a value for the performance of the university. Out of the many individuals that I interviewed there was a large variance in opinion in terms of the degree of assessment of the university lands and the communication associated. As such the rating that I have provided may not be indicative of actual performance and was formulated based on the limited time and resources available for the assessment.

In general, the degree to which the university has been involved with long-term monitoring and assessment of the Gordon Head lands has been minimal but has started to become more of a priority in recent years. To my knowledge, no formal ecological inventory other than that by Tatum et al. (1971) has been conducted and reviewed by the university prior to the Westland Resource Group assessment in 1993. Since that time there has been work done through the Trillium project on native plant issues on campus, the Campus Development Committee has been formed, and there is a new Westland Resource Group ecological review of the natural areas that is coming out this year. However, it appears that the university does not have any way to determine long-term trends of wildlife species on campus and other ecological factors such as tree recruitment into the forest stands.

Currently, a large amount of ecological information is present in the Herbarium in the Biology Department that extends many years into the past. This information was collected through many successive years of course work in Plant Ecology (Biology 418) and other plant courses in the department. At this time it is unclear whether this information was communicated to university management or not, and has most likely been largely ignored. There is important information regarding the soils, course woody debris, and percent cover of dominant species throughout all of the areas on campus dating back to the 1970's. For instance, in several documents that I compiled as a component of the Biology 418 course work I found that there was little or no tree recruitment within the South Woods, a situation aggravated by the dominance of ivy (Hocking 2000a,b). I feel that information such as this would be beneficial to campus planners. Furthermore, there are other courses that may have similar ecological databases that date back many years as well. Examples include Geography 101A and their work in Mystic Vale, as well as the Environmental Restoration program with their work done in the Garry Oak meadow.

As such it is clear that there is tremendous potential for the university to utilize information collected by students and other groups for the purpose of understanding the ecology of the remnant natural areas of the University of Victoria campus without the high cost of environmental contractors. A student work-study position could possibly be developed to manage, coordinate and investigate this knowledge and present it to the university for consideration. Since environmental values are highly expressed in the student and resident community in the UVic region the university should opt for increased involvement and project coordination for their maximum benefit.

2.1.8 The University strives to educate the campus and surrounding community about the natural areas on campus and the role that they can play as stewards of these areas. Rating: ★★☆☆☆

Discussion:

If you look on the University of Victoria website for information on the campus landscape you will find a map of the major roads, buildings and parking lots, but find no information regarding the presence of unique natural areas in this area. Many of these natural areas have no formal names and the extensive trail system not advertised. Furthermore, the extensive ecological values of the areas are only partly found in a myriad of private documents that are far beyond the reach of the average student or community member. It is thus no surprise that only 25% of the student population are aware of the Garry Oak meadow when there is no system for education of the campus community regarding campus ecology issues. Despite the poor awareness the questionnaire survey revealed that the sentiments towards preserving the integrity of the natural areas of the campus is high. Given that awareness should translate into higher value, further education of the campus community would give them more of an active role in environmental stewardship. This would reduce the effects of negligence and ignorance on the part of community members towards these areas, including the dumping of garden refuse, the spread of exotics, and trampling of sensitive plants. Particularly in reference to the situation regarding the spread of exotic species from community gardens, a management regime that ignores external influences will certainly fail to properly address conservation and sustainability. The university should be proud of the values that are present in the natural areas and should educate and encourage others to feel the same. Two main ways that the university could improve awareness and stewardship includes increasing community involvement and information display:

1) **Information display:**
    a) The university should be proud of the environmental values of the campus and use them to attract prospective students. A map with trails, names and some environmental attributes should be available to all students either on the internet or in the student calendar.
    b) There are no trail guides or information brochures produced by the university, and thus there is limited information available on the values of the natural areas. Could the university produce documents like this or provide funding for other groups to do so? The Trails and Tales guide to the UVic campus produced through this project is an example of such a document. How about

more signs along the trails themselves? In general increase the recognition for the values of the natural areas (i.e.- wildlife and plant species, regional significance etc..).

c) Better advertising for public forums on campus planning and development issues to increase input. Input should increase as awareness increases.

2) <u>Community Involvement</u>:

a) Contact appropriate residents regarding exotic plant issue and garden refuse. Encourage participation in conservation and stewardship.

b) Encourage student research projects to be submitted to the university for review relating to campus ecology. There are many projects that have taken place in the past that have been overlooked by the university due to poor coordination. Encourage select projects of interest to the university such as water quality in Hobbes and Bowker Creeks.

c) Encourage further integration of curricula into environmental theory and use of the on campus living laboratory.

d) Further coordination with concerned groups on and off of campus regarding campus ecology issues.

e) Development of a 'Natural Areas Policy' with input from students, community members and interest groups.

<u>Summary of Major Recommendations:</u>

The major recommendations for my report are included throughout the document, so for a more complete discussion see the appropriate section. The following is a summary of my major findings and recommendations.

1) Develop a 'natural areas' policy for sustainable management of university lands. The structure of the policy could be similar to that of Finnerty Gardens, and could include many of the following recommendations.
2) Where possible, preserve all remaining large natural areas of the campus into an urban wildlands network. In accordance to the Province of British Columbia at least 12% of the campus lands should be protected. Provide buffer zones of moderate use to reduce edge effects and segregation.
3) Establish a habitat trust fund for the university lands. Encourage donations by private organizations, university alumni, community members, and the government.
4) Expand and enhance the exotic species removal in Mystic Vale to include volunteers and students and educate campus community to minimize external influences of exotic species. Continued planting of more native plants throughout the campus to coincide with the removal project. This could include planting of native trees in the forested areas where recruitment is limited due to exotic plant disturbance.
5) Improve siting procedure to consider environmental features to the maximum extent possible. Factors to consider include impervious surface coverage, impact on neighboring areas, and individual species that are impacted by development. If development occurs then natural hydrologic functions of the site should be

maintained as much as possible. Retaining natural contours and vegetation, limiting the area exposed to soil compaction, and a design that reduces impervious coverage will minimize impacts to the site. Wildlife considerations have to be made as well.

6) As a general policy for UVic, think in terms of overall effects on entire watersheds, particularly with reference to Bowker Creek and Hobbes creek drainages.
7) Monitor and study impacts of erosion and poor water quality in the watersheds of the campus with student involvement to minimize cost and maximize education and stewardship. For example, undergraduate chemistry and biochemistry students could possibly perform chemical analyses for determination of water quality.
8) Do not remove wildlife trees from the forested areas of campus due to their status as essential feeding and nesting sites for wildlife. If possible, adopt the policy of Saanich Parks regarding safety concerns on campus with respect to dangerous trees.
9) The university should strive to inventory and monitor all of the wildlife species to form a wildlife checklist for the campus. This need not be accomplished solely through independent contractors when student and faculty resources are available through various departments. If long-term assessment is established then trends in species abundance can be determined and predicted. Of particular importance for monitoring and assessment is the bird community on the UVic campus. A bird checklist is of high value here.
10) Establishment of the key habitat requirements of species present on campus should be conducted prior to any further development in or around the natural areas. Rare or endangered species that are found should be even more rigorously studied. Reduction and degradation of these habitat requirements should be prevented.
11) Possible restoration and reintroduction of certain habitats and species on campus, conducted through the Environmental Restoration Program, and interested departments and community members. This includes an enhancement of the exotic species removal in Mystic Vale, restoration of the Garry Oak meadow, the construction of stairs in Mystic Vale up the east bank, and the possible restoration of other native grassland communities.
12) Reduce the notion of display over content in campus landscaping and planning. The myriad of ecological, educational and social values that these natural areas possess are far more important than the visual continuity and appearance.
13) In general, increase the inventory, monitoring, and assessment of the University of Victoria lands through student and community group involvement. Encourage student research and community projects to be submitted to the university for review relating to campus ecology. There is great potential for much work to be done through select projects of interest to the university by these groups.
14) Increase community wide education surrounding campus ecology issues to enhance awareness and stewardship for these areas. The university should be proud of the environmental values of the campus and use them to attract prospective students. In general the university should recognize the values of the natural areas (i.e.- wildlife and plant species, regional significance etc..) and make

them available to all. This could be in the form of maps or information brochures for distribution and on the internet.

Conclusion:

It is apparent that the University of Victoria has begun to be much more environmentally responsible in the last few years in response to increased pressure from the community and from society as a whole to do so. This has resulted in positive steps such as the ivy removal project that will improve the environmental conditions within the natural areas of the campus. Projects such as this will not only enhance native plant and wildlife populations they will increase student and community awareness for campus ecology issues. However, there is significant room for improvement in environmental policy at the University of Victoria particularly with reference to sustainable land use.

The university has stated that it should "review the many activities at the University of Victoria which relate to environmental quality, [and] to establish a set of environmental policies that are consistent with principles of environmental responsibility at local, national, and international levels" (University of Victoria 1999). In accordance to this statement I propose that the university adopt a 'Natural Areas Policy' that properly addresses the issue of sustainable land use on the Gordon Head Campus. Without excessive cost to the university, it could adopt many of the recommendations that I have presented above, particularly with the increased use of students and community members as an important resource. Increased awareness and education of these individuals regarding ecological issues will translate into increased stewardship and responsibility, patterns that will be reflected in their daily lives:

> "It is becoming increasingly apparent that our present environmental crisis is evidence of a prior failure of mind and perception- which is to say, a failure of education. The loss of species, topsoil, rainforests, and impending climate change are not primarily technological problems or even economic ones. They are first and foremost about how we think about the world we inhabit" (Orr 1991).

If universities such as the University of Victoria do not take a stand and become leaders in land use issues throughout the world who will?

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References:

Antos, J. 2000. Personal Communication. Department of Biology. University of Victoria, British Columbia.

Archibugi, F. 1997. The ecological city and the city effect: Essays on the urban planning requirements for the sustainable city. Ashgate Publishing Ltd. Aldershot, England.

Arnold Jr., C.L. & Gibbons, C.J. 1996. Impervious surface coverage: The emergence of a key environmental indicator. Journal of the American Planning Association 62(2): 243-258.

Association of University Leaders for a Sustainable Future. 1994. The Talloires Declaration: 10 Point Action Plan. http://www.center1.com/ulsf/

Cannings, R. and Cannings, S. 1996. British Columbia: A Natural History. Greystone Books, Vancouver.

Capital Regional District. 2000. Report on the environment: Monitoring trends in the capital regional district. http://www.crd.bc.ca.

Connaghan, C.J. 1991. Sustainable Communities: British Columbia round table on the environment and the economy.

Costanzo, B. 2000. Personal Communication. Department of Biology. University of Victoria, British Columbia.

Chatterson, B. 1995. A study of course woody debris and wildlife trees in the natural areas of UVic. Submitted to ES 490: University of Victoria, British Columbia.

CRD/ PCC green/ blue spaces strategy. 1996. Proposed green/ blue spaces system for the Saanich Peninsula, core communities, and western communities. Victoria, British Columbia.

Crookshank, M. 2000. Personal Communication. Pacific Forestry Center. Victoria, British Columbia.

Deshane, D. 2000. Personal Communication. Saanich Parks. Victoria, British Columbia.

Eastman, D. 2000. Personal Communication. Department of Environmental Studies. University of Victoria, British Columbia.

Erickson, W.R. 1996. Classification and interpretation of Garry Oak (Quercus garryana) plant communities and ecosystems in Southwest British Columbia. MSc. Thesis: Department of Geography, University of Victoria, British Columbia.

Farstad, L. & Day, J.H. 1959. Soil survey of Southeast Vancouver Island and Gulf islands, British Columbia. Report No. 6 of the British Columbia soil survey. Canadian Department of Agriculture.

Friends of Bowker Creek. 2000. http://members.home.net/chrisdare/bowker.htm

Iachetti, P., Trieu, T. & McQuillan, E. 1999. Urban restoration issues: Mystic Vale. Submitted to ER 331: Urban restoration and sustainable agriculture. University of Victoria, British Columbia.

Hartwig, C.L. 1999. Effect of forest age, structural elements, and prey density on the relative abundance of Piloted woodpecker (*Dryocopus pileatus abieticola*) on Southeast Vancouver Island. MSc. Thesis: Department of Biology, University of Victoria, British Columbia.

Hocking, M. 2000a. Community dynamics and vegetation sampling on the University of Victoria campus. Submitted to Biology 418: Victoria, British Columbia.

Hocking, M. 2000b. Understory cover and determination of vegetation dynamics on the University of Victoria campus. Submitted to Biology 418: Victoria, British Columbia.

James, T. 2000. Personal Communication. Facilities Management. University of Victoria, British Columbia.

Justice, C.L. 1961. Landscape and site development proposals for the University of Victoria campus. Muirhead & Justice Landscape Architects. Victoria, British Columbia.

Ketcheson, M.V., Kromm, K.L. and Wainwright, M.D. 1975. Mapping the vegetational history of the UVic campus. Submitted to Biology 418: Victoria, British Columbia.

Larocque, K.L. 1999. Blurred park boundaries and the spread of English Ivy (*Hedera helix* L.): Case studies from greater Victoria, British Columbia. MSc. Thesis, Department of Geography, University of Victoria.

Lovell, D. 2000. Personal Communication. Facilities Management. University of Victoria, British Columbia.

Machmer, M.M. & Steeger, C. 1995. The ecological roles of wildlife tree users in forest ecosystems. B.C. Ministry of Forests, Victoria, British Columbia.

Meffe, G.K. & Carroll, C.R. 1997. Principles of Conservation Biology. 2nd Ed. Sinauer Associates, Inc. Sunderland, Massachusetts.

Ministry of Environment Lands and Parks. 1993. Garry Oak ecosystems information brochure: Ecosystems of British Columbia at risk. Government of British Columbia.

Ministry of Environment Lands and Parks. 1998. Environmental trends in B.C. State of Environment Reporting. Victoria, British Columbia.

Ministry of Environment Lands and Parks. 2000. Provincial Wildlife Strategy to 2001. http://www.elp.gov.bc.ca. Government of British Columbia.

Newell, D.M.G. 1983. The terrestrial vertebrates of the university Endowment Lands. U.B.C. Technical Committee on the Endowment Lands. Technical Paper #1. Greater Vancouver Regional District Parks Department.

Orr, D. 1991. What is education for? Trumpeter 8:3 Summer 1991.

Pojar, J. & Mackinnon, A. 1994. Plants of British Columbia. Lone Pine Publishing, Vancouver.

Primack, R.B. 1993. Essentials of Conservation Biology. Sinauer Associates Inc., Sunderland, Massachusetts.

Protected Areas Strategy. 1994. A protected areas strategy for British Columbia. http://www.luco.gov.bc.ca/pas/. Province of British Columbia.

Public Relations and Information Services. 1993. Mystic Vale Ecological Protection Area. University of Victoria, British Columbia.

Reimchen, T.E. 2000. Personal Communication. Department of Biology, University of Victoria, British Columbia.

Ring, R. 2000. Personal Communication. Department of Biology, University of Victoria, British Columbia.

Shore, T. 2000. Personal Communication. Pacific Forestry Center. Victoria, British Columbia.

Siddall, R.W. & Dennis, D.D. 1964. Report on the master plan building program #2: interim proposal. R.W. Siddall & Associates. University of Victoria, British Columbia.

Stewart, A. 2000. Personal Communication. Wildlife Biologist- Cooper’s Hawks. Victoria, British Columbia.

Stinchcombe, K. 1995. Nature on campus: Restoration of the University of Victoria's Mystic Vale. Submitted to ES 400D: University of Victoria, British Columbia.

Tatum, J.B., Barclay, H., Harvey, T., Harcombe, A., Ring, R. and Saunders, A. 1971. Report of the ad hoc committee to investigate campus bird populations. Victoria, British Columbia.

Taves, L. 1994. The Trillium Project: Public attitudes and values regarding native vegetation issues at the University of Victoria. University of Victoria, British Columbia.

Turner, J. & Lovell, D. Eds. 1999. The changing face of the University of Victoria campus lands. Victoria, British Columbia.

Turner, N. 2000. Personal Communication. Department of Environmental Studies. University of Victoria, British Columbia.

University of Victoria. 1969. Basic campus planning questions. Victoria, British Columbia.

University of Victoria. 1998. UVic Campus Plan Update: Planning and Background Information. Victoria, British Columbia.

University of Victoria. 1999. Strategic Plan. http://web.uvic.ca/president/stratplan/

University of Victoria- Policies. 1973. Capital Expenditures on Physical Plant. http://web.uvic.ca/uvic-policies/pol-1000/1700CEPP.html.

University of Victoria- Policies. 1974. The Landscape Concept. http://web.uvic.ca/uvic-policies/pol-6000/6738LC.html.

University of Victoria- Policies. 1995. Finnerty Gardens. http://web.uvic.ca/ uvic-policies/pol-6000/6310FG.html.

Walker, T. 1994. Trillium Project: Context and Recommendations. University of Victoria, British Columbia.

Westland Resource Group. 1993. An environmental overview of the University of Victoria's eastern lands. Prepared for the University of Victoria, Victoria, British Columbia.

Westland Resource Group. 1997. Report on the Environment: Monitoring trends in the Capital Regional District- phase 1. CRD Roundtable on the Environment.

Winchester, N. 2000. Personal Communication. Department of Biology. University of Victoria, British Columbia.

Paul Levesque Literature Cited:

Campbell, R.W., N.K. Dawe, I. Mct/Cowan, J.M. Cooper, G.W. Kaiser, and M.C.E. Mcnall. 1990. The Birds of British Columbia- Volume 1: Nonpasserines. Royal British Columbia Museum and Canadian Wildlife Service, Victoria. Pp. 358 – 375.

Rand, A.L. 1994. Birds of the Alaska Highway in British Columbia. Banadian Field Naturalist 58:111-125.

Stirling, D. 1970. A sight record of the Barred Owl on Vancouver Island. Murrelet 51:19.

Tatum, J.B. 1970. Report of the ad hoc committee to investigate the campus bird Populations. University of Victoria Unpublished Report, Victoria, British Columbia. 32pp.

___1971. Bird report for southern Vancouver Island (1970). Victoria Natural History Society, Victoria, British Columbia. 66pp.

___1972. Bird report for souther Vancouver Island (1971). Victoria Natural History Society, Victoria, British Columbia. 66pp.

Appendix 1:

Research on each aspect:

2.1.1 Conversations with Don Lovell of facilities management, as well as Brenda Costanzo and Nancy Turner of Biology and Environmental Studies. Research on planning principals of the campus dating back to early development of the campus (found in archives). The Trillium project. The current campus plan update including the new (draft form) basic planning principles. The landscape policy for UVic (http://web.uvic.ca/uvic-policies/). The campus development committee.

2.1.2 Conversations with: Tony James of Facilities Management; Brenda Costanzo, Dr. Joe Antos, Dr. Tom Reimchen, Dr. Richard Ring, Dr. Asit Mazumder and Neville Winchester of the Biology Department; Nancy Turner and Don Eastman in Environmental Studies; Stewart Irwin of CRD (water quality division); David Deshane in Saanich Parks; Terry Shore and Mike Crookshank of the Pacific Forestry Center. Personal research in Biology 418. Research on the history of campus lands and the Coastal Douglas fir zone. The landscape policy. The Finnerty Gardens policy. The current campus plan. Westland Resource Group: An Environmental Overview of the University of Victoria Eastern Lands 1993 and 1999 (Facilities Management). Plant species lists and info in herbarium. Percent impervious surface within Ring Road. Ministry of Environment Lands and Parks website and the CRD website. The campus map/ trail guide. The Trillium Project. Mapping training with Briony Penn and Norm Mogensen of the Victoria Natural History Society. Research on the restoration of Mystic Vale with Ton Trieu, Pierre Iachetti and Erin McQuillan. Friends of Bowker Creek.

2.1.3 Conversations with: Dr. Tom Reimchen, Dr. Richard Ring, Neville Winchester, Bev Glover, Dr. Ted Davis, Dr. Pat Gregory and several grad students in Biology; Bird Biologist Andy Stewart; Dr. Don Eastman; Don Lovell and Tony James. Weekly winter bird surveys on campus and research in conjunction with group of volunteers, in particular Paul Levesque, Gavin Bieber and Katie Christie. The landscape policy. The current campus plan. Westland Resource Group: An Environmental Overview of the University of Victoria Eastern Lands 1993 and 1999 (Facilities Management). The

Ministry of Environment Lands and Parks website and the CRD website. Research on bird ecology and habitat requirements. Tatum et al. 1971.

2.1.4 UVic homepage. Direct questionnaire research into student values. The current campus plan. Conversations with Don Lovell, Tony James and Nancy Turner. Monitoring trail use. The Trillium Project.

2.1.5 Conversations with Don Eastman, Nancy Turner, Brenda Costanzo, and Tony James. The landscape policy. The current campus plan. Ivy removal program in Mystic Vale. The current campus plan.

2.1.6. Conversations with Dr. Nancy Turner, Brenda Costanzo, and Tony James. The landscape policy. The current campus plan. Personal research on the impacts of exotics. The Trillium Project. Biology 418 projects.

2.1.7. Conversations with Neville Winchester, Brenda Costanzo, Dr. Patrick Von Aderkas, Dr. Tom Reimchen, Dr. Nancy Turner, Don Lovell and Tony James. The Campus Development Committee. The landscape policy. The current campus plan. Biology 418 projects.

2.1.8. Conversations with Neville Winchester, Brenda Costanzo, Dr. Patrick Von Aderkas, Dr. Tom Reimchen, Dr. Nancy Turner, Don Lovell and Tony James. The Campus Development Committee. The landscape policy. The current campus plan. The UVic website. Evidence from questionnaire research.

Appendix 2:

Checklist of Vascular Plants of the UVic Campus University of Victoria Herbarium Contribution No. 3 Compiled by B. Costanzo, G. A. Allen and J. A. Antos April 1995; updated February 2000.

II. Overall Species List (* recorded by David Newell in 1983 list and "?" indicates doubtful occurrence or not inventoried since 1993)

Abies grandis
Acer circinatum -planted
Acer glabrum*?
Acer macrophyllum
Achlys triphylla
Adenocaulon bicolor
Agropyron repens

Agrostis alba*
Agrostis exarata*
Agrostis oregonesis*
Agrostis tenuis*
Aira praecox (outcrops)
Allium acuminatum
Alnus rubra
Alopecurus geniculatus
Amaranthus albus*
Amaranthus retroflexus*
Amelanchier alnifolia
Anagalis arvensis
Anemone lyalli*?
Anthemis arvensis*
Anthemis cotula
Anthoxanthum odoratum
Arabidopsis thaliana
Arbutus menziesii
Arenaria macrophyllum
Arrhenatherum elatius
Aruncus slyvester*?
Aster eatonii*
Aster hesperis*?
Aster sp.
Aster subspicatus
Athyrium filix-femina
Avena fatua
Barbarea verna*
Bellis perennis
Betula sp.
Bidens amplissima*
Brassica campestris
Brassica nigra*
Brassica sp.
Brodiaea coronaria
Brodiaea hyacinthina (=Triteleia hyacinthina)
Bromus carinatus*
Bromus pacificus
Bromus sitchensis*
Bromus tectorum*
Calandrinia ciliata
Capsella bursa-pastoris
Camassia quamash
Cardamine angulata
Cardamine oligosperma
Cardamine pulcherrima
Carex hendersonii

Cerastium arvense (outcrops)
Cerastium vulgatum*
Chenopodium album
Chrysanthemum leucanthemum
Cirsium arvense
Cirsium edule
Cirsium sp.
Conium maculatum*
Convolvulus arvensis
Convolvulus sepium
Corallorhiza maculata
Cornus stolonifera
Crataegus douglasii
Crataegus monogyna
Cynosurus cristatus
Cytisus scoparius
Dactylis glomerata
Daphne laureola
Daucus carota
Disporum hookeri*?
Dodecatheon hendersonii
Dodecatheon pulchellum*?
Dryopteris expansa
Echinochloa crusgalli*
Epilobium angustifolium
Epilobium munitum
Epilobium sp.
Epipactis helleborine
Equisetum arvense
Erodium cicutarium
Erythronium oreganum
Erythronium revolutum
Eschscholtzia californica*
Galium triflorum
Gaultheria shallon
Geranium carolinianum
Geranium dissectum*
Geranium molle (outcrops)
Geranium pusillum*?
Geum macrophyllum
Glyceria striata (in stream near bridge) Gnaphalium palustre*
Goodyera oblongifolia
Habenaria dilatatum
Hedera helix
Heracleum lanatum*
Hieracium sp.
Holcus lanatus

Holodiscus discolor
Hordeum leporinum*?
Hypericum formosum*
Hypericum perforatum*?
Hypochaeris radicata
Ilex aquifolium
Juncus balticus*
Juncus bolanderi*?
Juncus bufonius*
Juncus effusus (in drainage ditch) Juncus tenius
Lactuca communis
Lactuca muralis
Lamium purpureum
Lapsana communis
Lathyrus nevadensis
Leotodon taraxocoides*
Lepidium campestre
Lepidium heterphyllum*
Linaria canadensis*
Lolium perenne
Lomatium nudicaule
Lonicera ciliosa
Lonicera hispidula
Lupinus bicolor
Lupinus arboreus
Luzula campestris
Luzula sp.
Lysichitum americanum (aquatic)
Madia glomerata*?
Mahonia nervosa
Maianthemum dilatatum
Malus sp.
Matricaria maritima
Matricaria matricaria
Matricaria matricarioides
Medicago luplina*
Medicago sativa*
Melica subulata*
Melilotus alba
Melissa officinalis*
Monotropa uniflora
Montia linearis
Montia perfoliata
Montia sibirica
Myosotis discolor
Myosotis laxa*
Navarretia squarrosa

Nemophila parviflora
Oemleria cerasiformis
Oenanthe sarmentosa
Orobanche uniflora*
Osmorhiza chilensis
Oxalis stricta*
Pachistima myrsinites
Papaver argemone*
Phalaris arundinacea
Phalaris canariensis*
Philadelphus lewisii
Phleum pratense
Physocarpus capitatus
Plagiobothrys scouleri*
Plantago lanceolata
Plantago major
Poa annua*
Poa bulbosa*
Poa compressa*
Poa pratensis
Polygonum aviculare
Polygonum douglasii*
Polygonum lapathifolium
Polygonum persicaria*
Polypodium glycyrrhiza
Polystichum munitum
Populus tremuloides
Populus balsaminifera ssp. trichocarpa
Portulaca oleraceae*
Potentilla pacifica/anserina
Prunella vulgaris
Prunus emarginata
Pseudotsuga menziesii
Pteridium aquilinum
Pyrus fusca (=Malus fusca)
Quercus garryana
Ranunculus acris*
Ranunculus ficaria*
Ranunculus occidentalis
Ranunculus unicinatus
Ranunculus repens
Raphanus raphanistrum
Rhamnus purshiana
Rhinanthes minor
Ribes bracetosum*
Ribes lobbii
Ribes sanguineum

Rorippa curvisiliqua
Rosa gymnocarpa
Rosa nutkana
Rosa pisocarpa
Rubus discolor
Rubus parviflorus
Rubus spectabilis
Rubus ursinus
Rumex acetosa
Rumex crispus
Rumex occientalis*
Rumex obtusifolius (along lawn)
Salix hookeriana
Salix lasiandra
Salix scouleriana
Salix sitchensis
Sambucus racemosa
Sanicula crassicaulis
Satureja douglasii
Senecio vulgaris
Silene gallica*
Sisyimbrium officinale
Sisyrinchium angustifolium
Smilacina racemosa
Solanum nigra*
Solanum dulcamara
Spergula arvensis
Spergularia rubra*
Spiraea douglasii
Spiranthes romanzoffiana
Stachys cooleyae
Stellaria calycantha*
Stellaria media
Symphoricarpos albus
Taraxacum officinale
Taxus brevifolia
Tellima grandiflora
Thalspi arvense*
Thuja plicata
Tiarella trifoliata
Tragopogon porrifolius
Trientalis latifolia
Trifolium arvense*
Trifolium dubium
Trifolium pratense
Trifolium repens
Trillium ovatum

Tsuga heterophylla*?
Typha latifolia
Ulex europaeus*
Urtica dioica
Vaccinium parvifolium
Veronica arvensis*
Veronica americana
Veronia peregrina*
Veronica persica*
Veronica serpyllifolia*
Vicia cracca
Vicia hirsuta
Vicia sativa
Vicia villosa
Vulpia myuros*

Appendix 3:

Campus Bird Survey Data Form

Observers: _____ Date: _____

Station Number: _____ Time (arrived): _____ Time (departed): _____

Weather: Clear Partly Cloudy Cloudy(No rain) Light Rain Heavy Rain

Estimated Temperature: _____ Estimated Cloud Cover (%): _____

Wind Strength: Calm Slight Breeze Moderate Wind Strong Wind

Other Notes (ie. nests or wildlife trees in area):

_____

_____

Species Observed Frequency

_____

_____

_____

_____

_____

_____

_____

_____

_____

Station Number: _____ Time (arrived): _____ Time (departed): _____

Other Notes (ie. nests or wildlife trees in area):

_____

Species Observed Frequency

_____
_____
_____
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_____

Appendix 4:

Bird Species of the University of Victoria Campus:

Codes:
F = Seen by Biology 329 Friday morning birding trips
O = Seen by author and others in past four years
S = Seen on morning surveys, Spring 2000
H = Historical records predating 1990

COMMON NAME	CODE	COMMENTS
Double-crested Cormorant	O	few records, seen flying over campus
Great Blue Heron	F, O, S	commonly seen roosting and feeding in ponds, fall - spring
Turkey Vulture	F, O	large flocks soaring overhead in fall
Canada Goose	F, O, S	seen flying over campus
Trumpeter Swan	O	2 seen flying over campus on migration
Wood Duck	F	few records
Gadwall	F, H	few records
Eurasian Wigeon	F, O	two records
American Wigeon	F, O, S, H	common
Mallard	F, O, S, H	common, suspected nesting
Northern Shoveler	F, H	few recent records, historically common winter resident
Northern Pintail	F, O, H	few recent records, historically common winter resident
Green-winged Teal	F, O, H	overwinter on ponds
Hooded Merganser	F, O	few records
Bald Eagle	F, O, S	known to nest in Mystic Vale
Sharp-shinned Hawk	F, O, H	winter resident, low numbers
Copper's Hawk	F, O, S, H	known breeder, four nests in 1999
Red-tailed Hawk	F, O, S	uncommon, but seen regularly throughout the year

American Kestrel	H	no recent records
Merlin	F, O, S, H	an immature suckeyi was seen, Feb.12 and 17, 2000
Peregrine Falcon	F, H	few records
Ring-necked Pheasant	H	introduced, no recent records
California Quail	F, H	introduced ?, no recent records
Sandhill Crane	O	3 were seen flying over in migration, Oct. 99
Black-bellied Plover	H	no recent records, once common winter resident
American Golden-Plover	H	one sight record
Killdeer	F, O, H	year round resident, playing fields, nests
Willet	H	one sight record
Spotted Sandpiper	F	one sight record
Whimbrel	H	few records
Long-billed Curlew	H	one sight record
Western Sandpiper	H	no recent records, once common winter resident
Least Sandpiper	H	no recent records, once common winter resident
Pectoral Sandpiper	H	no recent records
Dunlin	H	no recent records, once common winter resident
Short-billed Dowitcher	H	no recent records, once common winter resident
Common Snipe	F, H	few recent records

Mew Gull	F, O	common winter resident
Herring Gull	F	few records
COMMON NAME	CODE	COMMENTS
Thayer's Gull	F, O	small flocks frequent lawns and fields in winter months
Western Gull	F	few records
Glaucous-winged Gull	F, O, S, H	common resident
Rock Dove	F, O, S, H	introduced, common resident, likely breeding
Band-tailed Pigeon	F, O, H	few recent records, once nested in wooded areas
Mourning Dove	H	no recent records
Barn Owl	H	one sight record
Western Screech-Owl	H	historically nesting, now thought to be extirpated
Great Horned Owl	F, O, H	known to nest in Mystic Vale
Barred Owl	F, O, S, H	suspected nesting
Northern Saw-whet Owl	H	one found dead, hit by an automobile
Common Nighthawk	H	no recent records, historical nesting
Black Swift	O	few recent sight records
Vaux's Swift	F, O	few recent sight records
Anna's Hummingbird	F, O, S	year round resident, spring 2000 at least 8 pairs
Rufous Hummingbird	F, O, S, H	common summer, likely breeding
Red-breasted Sapsucker	F	few records
Downy Woodpecker	F, O, S, H	year round resident, spring 2000 at least 3 pairs
Hairy Woodpecker	F, O, S, H	one pair, nests
Northern Flicker	F, O, S, H	year round resident, at least 1 pair spring 2000, likely more

Pileated Woodpecker	F, O, S, H	year round resident, at least 1 pair spring 2000
Olive-sided Flycatcher	O, H	current status unclear, few recent records
Willow Flycatcher	H	current status unclear, few recent records
Pacific-slope Flycatcher	F, O, H	current status unclear, few recent records
Northern Shrike	O, H	few records, seen in winter, in apple orchards
Cassin's Vireo	F, H	few records, suspected nesting
Hutton's Vireo	O, S	few records, suspected nesting
Red-eyed Vireo	H	one record
Steller's Jay	F, O	common most winters, but unpredictable
Northwestern Crow	F, O, S, H	common, nests
Common Raven	F, O, S, H	nests, 1 pair in Mystic Vale spring 2000
Sky Lark	H, F	introduced, once nested, few recent records
Tree Swallow	F, O, H	common summer, suspected nesting
Violet-green Swallow	F, O, S, H	common summer, suspected nesting
Northern Rough-winged Swallow	O	few records
Cliff Swallow	O, H	historically nested on McPherson Library
Barn Swallow	F, O, H	common, nests in University Center parkade
Chestnut-backed Chickadee	F, O, S, H	nests, common in wooded areas
Bushtit	F, O, S, H	nests, common in wooded areas
Red-breasted Nuthatch	F, O, S, H	nests, common in wooded areas
Brown Creeper	F, O, S, H	nests, common in wooded areas
Bewick's Wren	F, O, S, H	nests, common in wooded areas
Winter Wren	F, O, S, H	nests, common in wooded areas

Golden-crowned Kinglet	F, O, S, H	year round resident, common, nests
Ruby-crowned Kinglet	F, O, S, H	winter resident, common
Swainson's Thrush	F, O, H	summer resident, nests
Hermit Thrush	F, H	uncommon winter resident
American Robin	F, O, S, H	common, nests
Varied Thrush	F, O, S, H	winter resident, low numbers
European Starling	F, O, S, H	introduced, common, likely breeding
COMMON NAME	CODE	COMMENTS
American Pipit	F, O, H	few recent records
Cedar Waxwing	F, O, H	small flocks< 30 frequent campus
Orange-crowned Warbler	F, O, S, H	suspected nesting, few overwinter
Yellow warbler	F, O, H	suspected nesting
Yellow-rumped Warbler	F, O, H	suspected nesting
Black-throated Gray Warbler	H,O	few records
Townsend's Warbler	F, O, H	suspected nesting
Northern Waterthrush	F	one record, struck window at Cunningham
MacGillivray's Warbler	F, O, H	suspected nesting
Wilson's Warbler	F, O, H	suspected nesting
Western Tanager	F	few records

Spotted Towhee	F, O, S, H	common year round resident, nests
Chipping Sparrow	F, H	few recent records
Savannah Sparrow	F, H	few recent records, historically nested
Fox Sparrow	F, O, S, H	wintering, low numbers
Song Sparrow	F, O, S, H	common, year round resident, low numbers, nests
White-crowned Sparrow	F, O, H	year round resident, low numbers, nests
Golden-crowned Sparrow	F, O	winter resident, low numbers
Harris's Sparrow	O	one sight record, Jan 98
Dark-eyed Junco	F, O, S, H	common, year round resident, nests
Black-headed Grosbeak	H	no recent records
Red-winged Blackbird	F, O, S, H	year round resident, low numbers
Western Meadowlark	H	no recent records, historically nested
Yellow-headed Blackbird	H	few records
Brewer's Blackbird	F, H	few recent records
Brown-headed Cowbird	F, H	probable nest parasite of nesting birds
Purple Finch	F, H	few recent records
House Finch	F, O, S, H	common, year round resident, suspected nesting
Red Crossbill	F, O, S, H	common, year round resident
Pine Siskin	F, O, S, H	common, year round resident, suspected nesting
American Goldfinch	F, O, S, H	spring, summer, fall, low numbers
Evening Grosbeak	O, H	few recent records of small flocks
House Sparrow	F, O, S, H	introduced, common, nests

Species known to occur on campus, total: 123
Names and sequence of species are based on the American Ornithologist's Union Checklist of North American birds.
It should be noted that this list does not represent an exhaustive review of all literature and thus it is likely to be incomplete.

Appendix 5:

University of Victoria Sustainability Project:
Campus Ecology Questionnaire for Students.

This survey is being conducted by the University of Victoria Sustainability Project, as part of an effort to make practices at the University of Victoria more sustainable. My name is Morgan Hocking and I am doing a campus ecology audit, primarily focusing on the natural areas that exist on the University property. If you have any questions or concerns you can contact me directly at uvsp_ecology@hotmail.com, or you can reach our office at uvsp@hotmail.com. The supervising professor for this project is David Clode who can be reached at 721-8022 or 721-8023, or at via e-mail at stas@uvic.ca. The associate VP of research is Wolff-Michael Roth, who can be located in room 424 of the Business and Economics Building, or at 472-4362. You can address comments or concerns to any of these people.

We do not ask for your name, and you have the absolute right to not participate or to not answer questions that you feel uncomfortable in answering. By completing this questionnaire you are giving the researcher informed consent to use this information in a report. The surveys will be held in the UVSP office and locked up for the next five months, after which they will be shredded and recycled. Your participation is highly valued and sincerity and honesty when answering is greatly appreciated. There are no right or wrong answers. Thank you for your cooperation.

If you need more time to complete the questionnaire, drop it off or mail it to the UVSP office:
UVic Sustainability Project
University of Victoria, University House 4
PO Box 3060 Stn. CSC
Victoria, B.C. V8W 3R4
Ph. (250) 721-0372 Fax. (250) 721-6610

1. Do you visit or use any of the natural areas on campus such as Mystic Vale, the Garry Oak meadow, or the chip trails along Bowker Creek behind the Begbie building?

___ A. Frequently ___ B. Sometimes ___ C. Never

2. In what ways do you use the natural areas on campus? Check all that apply:

___ A. Exercise/ play ___ B. Observe/ enjoy nature
___ C. Course/ lab requirements ___ D. I do not use natural areas
___ E. Other_____

3. Are you aware that there currently exist some Garry Oak meadow ecosystem patches on campus?

___ A. Yes ___ B. No

4. Would you be concerned about this ecosystem type if you knew it was only found in the Victoria area?

___ A. Yes ___ B. No ___ C. Don't Know

5. Are you concerned with the use of non-native plants in campus landscaping?

___ A. Yes ___ B. No ___ C. Don't Know

6. If there were owls, Bald eagles, and other birds of prey nesting in the natural areas on campus, would you visit these areas more?

___ A. Yes ___ B. No ___ C. Don't Know

7. Would you support greater integration of the natural areas on campus into University curricula and activities (i.e. urban ecology and restoration, outdoor laboratories, nature walks, natural-history studies, etc.)?

___ A. Yes ___ B. No ___ C. Don't Know

8. Do you think that the University should be required to conduct environmental impact assessments when development is planned in any area on campus?

___ A. Yes ___ B. No ___ C. Don't Know

9. How highly do you value the forested natural areas on campus as they presently exist, given their potential for other uses?

___ A. High Value ___ B. Value Somewhat ___ C. Low Value

Thank you very much for your time.

If you are interested in becoming involved with the UVic Sustainability Project, please e-mail us at uvsp@hotmail.com, or visit our website: http://www.stas.uvic.ca/uvsp